

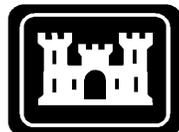
ARMY ACCESS CONTROL POINTS STANDARD DESIGN/CRITERIA



JANUARY 2009

Prepared By:

U.S. Army Corps of Engineers
Protective Design Center
Omaha District



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ARMY ACCESS CONTROL POINTS
STANDARD DESIGN/CRITERIA
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DEPARTMENT OF THE ARMY
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 WASHINGTON, D.C. 20314-1000

APR 15 2009

CEMP-ZA

MEMORANDUM FOR RECORD

SUBJECT: Approval for the January 2009 Revision of the Army Access Control Points (ACPs) Standard Design/Criteria

1. The 2009 revised Access Control Points Standard Design Criteria (Encl 1) is approved. This 2009 version supersedes the 14 December 2004 document in its entirety.
2. The Army Standard for ACPs, approved by the Army Facility Standardization Committee also on 14 December 2004, remains in effect. No changes are required to the Army Standard for ACPs based on this revision of the Army ACPs Standard Design/Criteria.
3. Revisions in the ACP Standard Design/Criteria include:
 - a. Incorporation of lessons learned.
 - b. More detailed layouts and equipment information.
 - c. Revised roadway geometry to improve traffic flow.
 - d. Addition of alternative roadway layouts to improve threat detection.
 - e. Revised floor plans and site plans to accommodate the future Automated Installation Entry (AIE) system.
4. We request the widest dissemination of the revised criteria. The USACE Center of Standardization (COS) POC for ACPs is Brian Erickson, at 402-995-2394.

FOR THE COMMANDER:

3 Encl


JEFFREY J. DORKO
 Major General, USA
 Deputy Commanding General
 for Military and International Operations

ARMY ACCESS CONTROL POINTS (ACP) STANDARD DESIGN/CRITERIA

1 INTRODUCTION

1.1 DEFINITIVE DESIGN

This Standard Design/Criteria supersedes all versions for this facility type. It shall be used for construction of all new ACP projects and renovations to existing ACP projects. It is intended for use anywhere in the continental United States or overseas locations. The design procedures and drawings included in this Standard Design/Criteria provide flexibility to Army ACP designers in meeting the Army's baseline physical security requirements and the full range of Force Protection Conditions on Army Installations. This Standard Design/Criteria meets the Army Standard for Access Control Points approved by the Army Facilities Standardization Committee and the ACP Criteria established by the Office of the Provost Marshal General (OPMG), who is the Army's proponent for Access Control Points. It also meets Architectural and Engineering design criteria established by the Headquarters U.S. Army Corps of Engineers (HQUSACE). The Chief of Engineering and Construction Division at HQUSACE must approve all changes, deviations, or waivers to the Standard Design/Criteria.

1.2 ACP DEFINITION

An Access Control Point is a corridor at an Installation entrance through which all vehicles and pedestrians must pass when entering or exiting the Installation. The perimeter of the ACP consists of both passive and active barriers arranged to form a contiguous barrier to pedestrians and vehicles. ACP guards control the active barriers to deny or permit entry into the Installation.

1.3 ACP PERFORMANCE REQUIREMENTS

ACP's shall be designed to prevent an unauthorized vehicle or pedestrian from entering the Installation, to ensure safety of innocent ACP users, and to maximize throughput of vehicular and pedestrian traffic. In order to meet these diverse and sometimes conflicting requirements, Army ACP designers must consider local site constraints and then use creativity and innovation to develop design solutions that meet all of the ACP performance requirements. There are no cookie-cutter design

solutions. Each design is unique. Designers must carefully consider all of the criteria and then select and design protective measures that will be most effective for the given site.

2 ACP DESIGN CRITERIA

2.1 THE ARMY STANDARD FOR ACPs

The Army Facilities Standardization Committee established the Army Standard for Access Control Points on 14 December 2004. The standard lists mandatory requirements for all Army ACPs. The standard is included in Appendix A. The Army Facilities Standardization Committee must approve changes, deviations, or waivers from this standard.

2.2 OFFICE OF PROVOST MARSHAL GENERAL (OPMG) DESIGN CRITERIA

OPMG, as the Army's proponent for Access Control Points, provided their criteria for ACP's in a document titled "ACP Criteria from OPMG" dated 19 November 2004, which was subsequently updated in July 2008 and approved by OPMG on 10 December 2008. The OPMG Criteria consist of mandatory requirements and non-mandatory recommendations. Mandatory requirements in the criteria are designated by the words "shall", "will", or "must", whereas non-mandatory recommendations are designated by the words "should", "can", or "may". The current OPMG Criteria have been made a part of this Standard Design/Criteria. The OPMG Criteria is included in Appendix B.

2.3 STANDARD DESIGN/CRITERIA DRAWINGS

The Protective Design Center (PDC) of the U.S. Army Corps of Engineers (USACE), as the Center of Standardization (COS) for Army Access Control Points, developed Standard Design/Criteria drawings for ACP's. These drawings incorporate the Army Standard for ACPs, the OPMG Criteria for ACPs, and other applicable criteria. They also provide mandatory requirements and recommendations to Army ACP designers and Installation Security Specialists for designing Army ACPs. The drawings have been made a part of this Standard Design/Criteria and are included in Appendix C.

2.4 OTHER CRITERIA

ACP designers are responsible to identify additional criteria such as applicable design codes, security (anti-terrorism), sustainability, energy conservation, environmental stewardship, and the Installation Design Guide

for each ACP project developed from this Standard Design/Criteria at the time project design work is authorized.

3 DESIGN PROCEDURE

The Designer must evaluate the criteria in paragraph 2 above and select ACP features that detect possible threats and ACP features that will delay the threats for the delay times required in the criteria. Detection features include vehicle speed detectors, vehicle wrong-way detectors, vehicle presence detectors, and detection by security guards. Delay features for vehicles include straight roadways, curved roadways, and roadways with chicanes or turns. Based on the opportunities and constraints of the site, the designer must determine appropriate detection and delay features and perform calculations to assure that the selected features provide the delays required for each Threat Scenario listed in the criteria. The design engineer must prepare a Design Analysis including descriptions of selected ACP features, layouts of detection and delay features, and calculations verifying delay times. Step-by-step procedures along with examples are included in Appendix D.

4 CONTROL OF ACTIVE VEHICLE BARRIERS (AVBs)

Active vehicle barriers are an essential element in preventing unauthorized motorists from entering Army Installations. However, an active vehicle barrier capable of stopping large, moving vehicles can cause significant damage to vehicles and can cause injury or even death to vehicle occupants. Through Army policy and design criteria, ACP designs must include adequate safety features to ensure the safety of motorists entering and exiting the ACP. The active vehicle barrier controls are an essential element of the ACP safety features. Active vehicle barrier controls must provide sufficient information to ACP guards to help them decide when to deploy the barriers. Active vehicle barrier controls must also close the active barriers upon command of the guards in order to stop a threat vehicle. Finally, the active vehicle barrier controls must provide sufficient warning to non-threat vehicles to allow them to either clear the barrier or stop safely in front of it before it is closed.

4.1 SENSORS

Barrier controls include sensors that may be required to detect a vehicle going the wrong way in the ACP, a vehicle speeding through the ACP, and a vehicle's presence at a specific location in the ACP. Sensor systems for over-speed, wrong-way, and vehicle presence shall utilize proven sensor technology and equipment.

4.1.1 Wrong Way Detection

Wrong way sensors, when required, are usually deployed in all outbound lanes at the ACP entrance and after each Turn-around from the inbound lanes. Wrong way detectors can utilize induction loops, video motion cameras, microwave, laser, or other appropriate sensor technology. Location of sensors is a function of the protective system design and the type(s) of sensors used.

4.1.2 Point Over-Speed Detection

Point over-speed sensors, when required, are used to detect speeding vehicles at calculated distances in front of the ACP Check Point. At each calculated distance, sensors must detect speeding vehicles in all inbound and, if required, all outbound lanes. Point over-speed detectors can utilize induction loops, video motion cameras, microwave, laser, or other appropriate sensor technology. Location of sensors is a function of the protective system design and the type(s) of sensors used.

4.1.3 Continuous Over-Speed Detection

Continuous over-speed sensors may be deployed in the Approach and Access Control Zones to defeat Threat Scenario #2 (see description of Threat Scenarios in Appendices B and D). Continuous over-speed detectors can utilize video motion cameras, forward/backward looking microwave or laser sensors, or other appropriate sensor technology. Induction loops and side fired microwave and laser sensors are not suitable for continuous over-speed detection. Location of sensors is a function of the protective system design and the type(s) of sensors used.

4.1.4 Vehicle Presence Detection

Vehicle Presence Detectors (VPDs) shall be deployed at all active vehicle barriers to detect a vehicle immediately in front of or behind the barrier. Detection of a vehicle traveling through the zone of these VPDs will suppress a barrier “close” command. VPDs shall also be deployed in the “Vehicle Presence Detection” safety system to detect vehicles that are stopped at a Stop Signal ahead of the barrier. VPDs can utilize induction loops, video motion cameras, microwave, break beam, or other appropriate sensor technology.

4.2 PROCUREMENT

The supplier of the active vehicle barriers at a given ACP shall be required to provide all barrier controls in accordance with UFGS 34 41 26.00 10 “Access Control Points Control System”. Controls shall include all required over-speed, wrong-way, and vehicle presence sensors; traffic warning signs

and signals; traffic control signals near the barrier; gate arms at the barrier (when applicable); barrier control panels including switches and indicating lights; Annunciator panels for gate guards; and traffic controller units (TCUs) to control the barriers and the warning and traffic signals associated with the barriers.

4.3 INSTALLATION

The active vehicle barrier supplier shall be required to provide on-site direction to the installation contractor (if different than the supplier) during installation of all barrier control elements and connecting wiring per UFGS 34 41 26.00 10 “Access Control Points Control System”.

4.4 COMMISSIONING

The barrier supplier shall be required to conduct all barrier control system commissioning activities per UFGS 34 41 26.00 10 “Access Control Points Control System” including, training, performance verification testing, and endurance testing. The active vehicle barrier supplier shall be required to submit for approval complete schematics and logic diagrams of the barrier control system along with complete test procedures for all commissioning tests. Commissioning tests must verify barrier performance for all modes of operation including the full range of operation of all sensors utilized in the barrier control system.

5 COSTS

All ACPs are different depending on traffic volume, internal and external roadway configurations, and site opportunities and constraints. Appendix E includes a cost estimate of an ACP with specifically defined parameters. However, the costs of the various ACP components can be extracted from this estimate and applied to a wide variety of ACP configurations to obtain programming level costs.

6 OTHER DESIGN CONSIDERATIONS

6.1 PASSIVE BARRIERS

6.1.1 Stopping Capacity

The OPMG Criteria in Appendix B require that passive barriers along the ACP corridor be capable of stopping a 15,000 pound vehicle traveling at the maximum velocity and approach angle that it can attain before impacting the barrier. The capacity in kinetic energy (KE) of a passive barrier that is

required to stop a vehicle with a mass of M impacting the barrier at an angle of θ° and traveling at a velocity of V is:

$$KE = \frac{1}{2} * M * (\sin(\theta) * V)^2$$

The $\sin(\theta) * V$ term is the component of the threat vehicle's velocity that is perpendicular to the barrier. The capacity of a passive barrier that is required to stop a 15,000 pound threat vehicle impacting the barrier at 90° and traveling at 30 miles per hour (mph) is 451,000 foot-pounds (ft-lbs). The capacity of a passive barrier required to stop a 15,000 pound threat vehicle impacting the barrier at 25° and traveling at 30 mph is 80,540 ft-lbs, which is a significant reduction from the kinetic energy in the 90° impact case. Reducing the impact angle of the threat vehicle through ACP corridor design can significantly reduce the energy stopping requirement for passive barriers. See Appendix D for a procedure for determining approach angles, velocities, and resulting energy stopping requirements for passive barriers along ACP corridors.

6.1.2 Acceptable Passive Barriers

The vehicle stopping capability of a passive barrier can be determined through crash testing or by engineering analysis. The following are acceptable passive barriers for use at Army ACPs:

1. Included on the list of U.S. Department of State Certified Anti-Ram Vehicle Barriers,
2. Included on the list of DOD Certified Anti-Ram Vehicle Barriers maintained by the Protective Design Center, or
3. Verified by calculations performed and/or checked by a registered Professional Structural Engineer with experience in the design and application of passive barrier systems. Stamped and signed copies of the calculations shall be obtained and maintained on file by the barrier purchasing agency and by the using Army Installation.

6.2 ELECTRICAL LOADS

Electrical loads include Utility loads, Emergency Generator loads, and Uninterruptible Power Supply (UPS) loads. The OPMG Criteria in Appendix B describes requirements for the Emergency Generator and UPS loads. Drawing E1.02 in Appendix C shows an overall summary of all three types of loads for a typical large ACP. A detailed listing of the loads for a typical large ACP is included in Appendix F. Electrical loads for a specific ACP must be determined on a case by case basis.

6.3 BARRIER SAFETY SYSTEMS

As described in the OMPG Criteria in Appendix B, there are three active barrier safety systems that have been approved by the Surface Development and Distribution Command (SDDC) for use at Army ACPs. One of these safety systems must be used whenever an active vehicle barrier is installed at an Army ACP. These safety systems are:

6.3.1 Signs and Signals

This system employs warning signs and signals to alert non-threat vehicles of impending vehicle barrier deployment. Barrier deployment is delayed for four seconds from the time the guard initiates an Emergency Fast Operate (EFO) command to allow warning signals to sequence. See drawing C9.10 in Appendix C.

6.3.2 Vehicle Presence Detection

This system consists of a Stop Line in front of each barrier, a lane control type traffic signal at the Stop Line, and Vehicle Presence Detectors before the Stop Line and before and after each barrier. The traffic signal will normally indicate “red” requiring all motorists to stop at the Stop Line in front of the barrier. The VPD in front of the Stop Line will sense the vehicle’s presence and change the lane control signal from “red” to “green” allowing the motorist to proceed over the barrier. If a guard initiates an Emergency Fast Operate command when the signal is “red” **and** there are no vehicles detected on the VPDs ahead of or behind the barrier, the barrier will close immediately thus eliminating the four second delay required in the Signs and Signals Safety System described above. This system is shown on drawings C3.17, 18, and 19 in Appendix C. Also, see Appendix G and drawings E1.03, E1.05, and E1.06 in Appendix C for information on logic control of the sensors, lane control signals, and barriers.

6.3.3 Normally Closed Operation

This safety system requires that two sets of barriers be installed to create an “entrapment area” in each inbound and outbound lane. One of the two barriers in each entrapment area must be closed. This system can be utilized when real estate for the ACP is limited. The distance between the two sets of barriers must be large enough to accommodate the largest vehicle served by the ACP, or it could be made larger to provide space for platooning multiple vehicles. Drawing C3.08 in Appendix C shows this safety system with the minimum space between barrier sets, and drawing C3.16 in Appendix C shows this safety system for a platooning operation.

APPENDIX A

THE ARMY STANDARD

FOR

ACCESS CONTROL POINTS

APPENDIX A
THE ARMY STANDARD FOR ACPs
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DEPARTMENT OF THE ARMY
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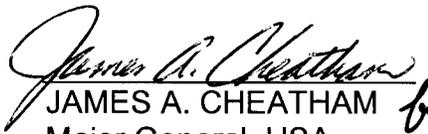
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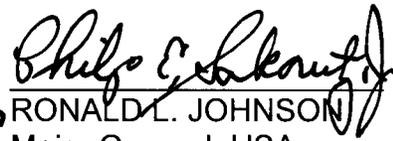
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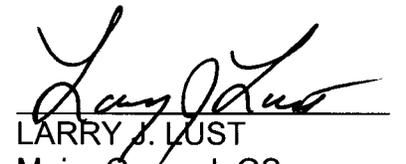
MEMORANDUM FOR RECORD

SUBJECT: The Army Standard for Access Control Points

1. The Army Standard for Access Control Points is approved for implementation. This Standard establishes mandatory features for Army Access Control Points (ACPs). It applies to all active Army installations and reserve components prime installations. Only the Army Facilities Standardization Committee has the authority to approve exceptions to this Standard. Waivers from the Army Standard must be approved through the installation management chain of command in accordance with AR 415-15.
2. The Army Standard for Access Control Points is mandatory for operations and maintenance projects starting FY2006 and beyond. For programming purposes requiring the use of Military Construction, Army/Army Reserve/National Guard appropriations, all projects from FY2008 and after must apply the Army Standard.
3. The proponent of this Standard is the Army Facilities Standardization Committee. Supplementation of this Standard is prohibited without prior approval from the Committee. The Army Standard for Access Control Points will be periodically reviewed and as needed, updated. The Army Standard for ACPs will be posted to the Army Installation Design Standards. Recommended changes with supporting rationale should be sent through the chain of command directly to the Assistant Chief of Staff for Installation Management, ATTN: Access Control Points Facilities Design Team (DAIM-MD), 600 Army Pentagon, Washington, DC 20310-0600.


JAMES A. CHEATHAM
Major General, USA
Acting Director for Military
Programs
Army Facilities
Standardization Committee
30 Nov 2004
(Date)


RONALD L. JOHNSON
Major General, USA
Director, Installation
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Standardization Committee
12/14/04
(Date)


LARRY J. LUST
Major General, GS
Assistant Chief of Staff for
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13/12/04
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THE ARMY STANDARD

For Access Control Points (ACPs)

December 2004



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The Army Standard for Access Control Points – December 2004

The Army Standard for Access Control Points – December 2004

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The Assistant Chief of Staff for Installation Management, HQDA (Preparing Agent)

The United States Army Corps of Engineers

The Installation Management Agency

Record of Changes (changes are indicated by \1\ ... /1/)

Change No.	Date	Location

This Army Standard supersedes the HQDA memorandum, 26 February 2004, subject: Interim Army Standards for Canopies at Army Installation Access Control Points

The Army Standard for Access Control Points – December 2004

FORWARD

This printing publishes the Army Standard for Access Control Points (ACPs). The Army Facilities Standard process is explained in AR 415-15. This Army Standard establishes mandatory features for Army ACPs. It applies to all active Army installations and reserve components prime installations.

The proponent of this Standard is the Army Facilities Standardization Committee. Supplementation of this Standard is prohibited without prior approval from the Committee. Technical advice concerning the Army Standard is the responsibility of the Center of Standardization – the United States Army Corps of Engineers Omaha District. Users are invited to contact the Center of Standardization for document interpretation.

The Army Standard for Access Control Points is mandatory for operations and maintenance projects starting FY2006 and beyond. For programming purposes requiring the use of Military Construction, Army/Army Reserve/National Guard appropriations, all projects from FY2008 and after must apply the Army Standard.

Only the Army Facilities Standardization Committee has the authority to approve exceptions to this standard. Waivers from the Army Standard must be approved through the installation management chain of command in accordance with AR 415-15.

The Army Standard for Access Control Points will be periodically reviewed and as needed, updated, and made available to users as part of the Army's responsibility for providing technical criteria for military construction. The Army Standard for ACPs will be posted to the Army Installation Design Standards. Recommended changes with supporting rationale should be sent through the chain of command directly to the Assistant Chief of Staff for Installation Management, ATTN: Access Control Points Facilities Design Team (DAIM-MD), 600 Army Pentagon, Washington, DC 20310-0600.

The Army Standard for Access Control Points – December 2004

1 INTRODUCTION

1-1 **PURPOSE AND SCOPE.** This document provides standards for Army access control points (ACPs). The Army Facilities Standardization Committee (AFSC) under the Department of the Army Facilities Standardization Program publishes the Army Standard. The AFSC is composed of the Headquarters, Department of the Army, Assistant Chief of Staff for Installation Management (ACSIM); The Director for Military Programs, Headquarters, US Army Corps of Engineers (USACE); and the Director, Installation Management Agency (IMA). Publication of the Army Standard for Access Control Points is by electronic media on the Internet at the ACSIM Installation Design Standards website.

1-2 **APPLICABILITY.** This Army Standard applies to all Army active installations and reserve components prime installations where government or contractors plan for, construct, and maintain Army access control points.

1-3 **REFERENCES.** Appendix A.

2 REQUIREMENTS

2-1 **ACP FUNCTION CLASSIFICATION.** Army physical security policy requires all Army installations to restrict access. Access Control Points are the physical assets along with manpower and operational procedures that commanders employ to control access to Army installations. Army ACPs shall be categorized as follows:

Table 2-1 ACP Use Classifications

Use Classification	Operational Hours	Preferred Operation
Primary	24/7 Open continuously	Vehicle registration/visitor pass capacity. Could also be designated as truck and delivery gate.
Secondary	Less than 24/7 with regular operating hours	Regular operations, visitors with authorization. Could also be designated as truck and delivery gate.
Limited Use	Only opened for special purposes or special events	Tactical vehicles, HAZMAT, special events.
Pedestrian	Varies	Personnel only. Could be located near installation housing areas, near schools, or as part of a Primary or Secondary ACP.

The Army Standard for Access Control Points – December 2004

2-2 PRIMARY AND SECONDARY ACP REQUIREMENTS. The following requirements apply to all Primary and Secondary ACPs except as noted:

2-2.1 Performance Standard. ACPs must be designed to defeat the vehicle and pedestrian threats prescribed in the ACP Criteria from the Office of the Provost Marshal General (Appendix B in the Standard Designs for ACPs), and to ensure safety of motorists, pedestrians, and guards.

2-2.2 ACP Corridor. ACPs must have both passive and active vehicle barriers forming a contiguous perimeter around the ACP.

2-2.2.1 Passive Barriers. Passive barriers must be capable of preventing penetration of a threat vehicle.

2-2.2.2 Active Vehicle Barriers. Active vehicle barriers, controlled by ACP guards, must be utilized in each inbound and outbound lane to permit or deny vehicle access.

2-2.2.3 Active Vehicle Barrier Safety. An active vehicle barrier safety regime must be utilized that conforms to one of the Surface Deployment and Distribution Command – Transportation and Engineering Agency (SDDC-TEA) approved safety protocols.

2-2.3 Control. ACPs must have zones established to control the flow of vehicular and pedestrian traffic in order to detect, assess, and respond to prescribed threats.

2-2.4 Entry Gate. ACPs must have an entry gate capable of securing the ACP. The entry gate must provide the same level of protection as the adjoining perimeter, and should appear to resemble the adjoining perimeter fence and / or barriers

2-2.5 Identity Check Area. ACPs must have an identity check area within the access control zone where guards or automated equipment verify pedestrians, vehicles, and vehicular occupants identifications; perform limited searches; and validate authorizations to enter the installation. The identity check area must include:

2-2.5.1 Identity Check Area Canopy. Identity check area must be covered with a canopy over all inbound lanes.

2-2.5.2 Entry Lanes. ACPs must have at least two lanes in the identity check area.

2-2.5.3 Traffic Islands. ACPs must have raised, curbed islands to separate all inbound lanes in the identity check area.

2-2.5.4 Guard Booths. ACPs must have a guard booth building for each lane of incoming traffic for use by guards performing vehicle/passenger identity checks.

The Army Standard for Access Control Points – December 2004

2-2.5.5 **Lighting.** Identity check area must provide adequate lighting for visual inspection of identification cards and documents.

2-2.6 **Turn-around Lanes.** ACPs must have at least two turn-around lanes, one before and one immediately after the identity check or vehicle search area.

2-2.7 **Gatehouse.** ACPs must have a gatehouse with the primary controls for the final active vehicle barriers. The gatehouse must be sized to accommodate ACP guards and their activities.

2-2.8 **Search Area.** ACPs must have a covered area separated from and easily accessible to the identity check area and obscured from casual observation from the identity check area. The size of the search area must be determined from a traffic engineering study. However, for search areas that allow trucks, the area must be sized to accommodate a minimum of one WB-62 tractor-trailer. For areas that do not allow trucks, the search area must be sized to accommodate a minimum of two passenger-sized vehicles.

2-2.8.1 **Search Area Building.** Search areas must have an adjacent or nearby building to shelter vehicle occupants from inclement weather. The building will facilitate guards' observation of vehicle occupants.

2-2.8.2 **Consolidated Search Area Building.** For ACPs with both truck and passenger search areas, one consolidated search area building is sufficient if the search areas are near each other.

2-2.9 **Overwatch Position.** ACPs must have a strategically located area suitable for an overwatch position that includes controls for the final active vehicle barriers.

2-2.10 **Visitors Control Center (VCC).** Installations must have a building for processing visitors. The building must be sized for the effective throughput of the expected number of visitors.

2-3 **LIMITED USE ACPs.** The following requirement applies to all Limited Use ACPs:

2-3.1 **Performance Standard.** Limited Use ACPs shall provide means to defeat the vehicle and pedestrian threats prescribed in the ACP Criteria from the Office of the Provost Marshal General (Appendix B in the Standard Designs for ACPs), and to ensure safety of motorists, pedestrians, and guards. Portable facilities including passive and active barriers, guard booths, and lights shall be used and configured to meet the requirements of limited use.

The Army Standard for Access Control Points – December 2004

2-3.2 **Control.** Limited Use ACPs must have zones established to control the flow of vehicular and pedestrian traffic in order to detect, assess, and respond to prescribed threats.

2-3.3 **Entry Gate.** Limited Use ACPs must have an entry gate capable of securing the ACP. The entry gate must provide the same level of protection as the adjoining perimeter, and should appear to resemble the adjoining perimeter fence and / or barriers.

2-3.4 **Identity Check Area.** Limited Use ACPs must have an identity check area where guards can verify pedestrians, vehicles, and vehicular occupants identifications; perform limited searches; and validate authorizations to enter the installation. The identity check area shall be configured to accept portable facilities to include passive and active barriers, guard booths, and lights.

2-3.5 **Turn-around Lanes.** Limited Use ACPs shall provide means for turn-around of vehicles. Where operational procedures are not adequate for control, a turn-around lane is required and shall be located before the identity check area.

2-4 **PEDESTRIAN ACPs.** The following requirements apply to all Pedestrian ACPs.

2-4.1 **Performance Standard.** Pedestrian ACP's must be designed to defeat the pedestrian threats prescribed in the ACP Criteria from the Office of the Provost Marshal General (Appendix B in the Standard Design for ACPs), and to ensure the safety of pedestrians and guards.

2-4.2 **Pedestrian Corridor.** Pedestrian ACPs must have both passive and active barriers forming a contiguous perimeter around the ACP.

2-4.2.1 **Passive Barriers.** Passive barriers must be capable of preventing easy circumvention or penetration by a pedestrian.

2-4.2.2 **Active Pedestrian Barriers.** Pedestrian ACPs must include active pedestrian barriers controlled by the ACP guards to permit or deny pedestrian access.

2-4.3 **Control.** ACP must have zones established to control the flow of pedestrian traffic in order to detect, assess, and respond to prescribed threats.

2-4.4 **Entry Gate.** Pedestrian ACPs must have an entry gate at the ACP entrance capable of closing off the ACP. The entry gate must provide equivalent security and equivalent appearance as the adjoining perimeter fence/barrier. If the active pedestrian barrier is located at the installation perimeter, a separate entry gate is not required.

The Army Standard for Access Control Points – December 2004

2-4.5 Identity Check Area. Pedestrian ACPs must have an identity check area within the access control zone where guards or automated equipment verify pedestrians' identifications, perform limited searches, and validate authorizations to enter the installation. The identity check area must include:

2-4.5.1 Guard Booths. Pedestrian ACPs must have a guard booth for use by guards performing pedestrian identity checks.

2-4.5.2 Lighting. Identity check area must provide adequate lighting for visual inspection of identification documents.

The Army Standard for Access Control Points – December 2004

APPENDIX A

REFERENCES

GOVERNMENT PUBLICATIONS:

1. Department of Defense

DefenseLink Publications Internet site
<http://www.defenselink.mil/pubs/>

DoD Directive 5200.8, Security of
DoD Installations and Resources

DoD 5200.8-R, DoD Physical Security
Program

DoD Instruction 2000.16, DoD
Antiterrorism Standards

Unified Facilities Criteria (UFC) Index
[http://65.204.17.188//report/doc_ufc.h
tml](http://65.204.17.188//report/doc_ufc.html)

Unified Facilities Criteria (UFC) 4-
012-01, Security Engineering: Entry
Control Facilities / Access Control
Points.

2. Department of the Army

Army Electronic Publications Internet
site <http://www.army.mil/usapa/>

AR 190-13, The Army Physical
Security Program

AR 415-15, Army Military construction
Program Development and Execution

Army IDS web site
[http://www.mantech-
mec.com/army_ids](http://www.mantech-mec.com/army_ids)

Army Installation Design Standards

Army Standard Design for ACPs

HQDA memorandum, Interim Army
Standards for Canopies at Army
Installation Access Control Points

SDDC-TEA web site
[http://www.tea.army.mil/cdrom/readm
es/allsections.htm#gates](http://www.tea.army.mil/cdrom/readmes/allsections.htm#gates)

Surface Deployment and distribution
Command-Transportation and
Engineering Agency publication,
Traffic Engineering for Better Gates

3. Department of Transportation

Federal Highway Administration web
site <http://mutcd.fhwa.dot.gov>

Manual on Uniform Traffic Control
Devices and Standard Highway Signs

The Army Standard for Access Control Points – December 2004

APPENDIX B
ACP CRITERIA FROM OPMG

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ACP CRITERIA FROM OPMG
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REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
OFFICE OF THE PROVOST MARSHAL GENERAL
2800 ARMY PENTAGON
WASHINGTON, DC 20310-2800

DAPM-MPP-PS

DEC 10 2008

MEMORANDUM THRU ARMY CHIEF OF STAFF FOR INSTALLATION MANAGEMENT (ACSIM), 600 ARMY PENTAGON, WASHINGTON, DC 20310-0600

FOR UNITED STATES ARMY CORPS OF ENGINEERS, PROTECTIVE DESIGN CENTER (CENWO-ED-S), 1616 CAPITOL AVENUE, SUITE 9000, OMAHA, NE 68102-4901

SUBJECT: Review of Proposed Changes to Access Control Point (ACP) Physical Security Criteria from the Office of the Provost Marshal General (OPMG), November 2004

1. References:

- a. Army Regulation 420-1, Army Facilities Management, February 2008.
- b. The Army Standard for ACPs, December 2004.

2. The OPMG has reviewed and concurs with the United States Army Corps of Engineers (USACE) Protective Design Center (PDC) recommended changes to the November 2004 ACP Physical Security Criteria from the OPMG (Encl).

3. Request OPMG review and concur prior to any future supplementation or modification of the physical security requirements contained within the standard.

4. I sincerely appreciate the professional efforts of the USACE PDC working hand-in-hand with the OPMG staff; reevaluating and incorporating the necessary physical criteria into the Army Standard for ACPs to ensure our Soldiers, civilians and family members living and working on Army installations remain safe.

5. My point of contact for this action is Mr. Richard Patrick, COMM (703) 614-2597.

Encl


RODNEY L. JOHNSON
Brigadier General, USA
Provost Marshal General

ACP Criteria from OPMG –July 2008

- A. The following four types of ACP shall be considered when designing an ACP:
1. Primary - operates 24 hours per day 7 days a week – 24/7.
 2. Secondary - operates during regular hours but less than 24/7.
 3. Limited Use - open only for special purposes or special events.
 4. Pedestrian - is designated for pedestrians and bicyclers only.
- B. ACP Functions. ACPs shall be designed for the following functions:
1. Vehicle Screening. All vehicles shall be screened for authorization to enter the installation.
 2. Personnel Identification Validation. The identification of all personnel entering the installation shall be verified along with their authorization to enter the installation.
 3. Personnel and vehicles shall be checked and/or searched per prevailing Force Protection Conditions and local procedures.
- C. Traffic Engineering Study. A traffic engineering study shall be conducted prior to the modification of an existing ACP; prior to the implementation of active vehicle barriers and automated technologies; and prior to the design of a new ACP. The traffic engineering study shall include scaled CADD drawings with bar scales and north arrows. Traffic engineering studies are subject to the review and approval of the Surface Deployment and Distribution Command – Transportation Engineering Agency (SDDCTEA) as well as the Army Corps of Engineers' Protective Design Center (PDC). The traffic engineering study shall consist of the following:
1. Perform an assessment of compliance of existing/proposed facilities with Unified Facilities Criteria (UFC) 4-022-01, Security Engineering: Entry Control Facilities/ Access Control Points; Department of the Army, Army Access Control Points Standard Design/Criteria; and SDDCTEA Pamphlet 55-15, Traffic and Safety Engineering for Better Entry Control Facilities.
 2. Conduct a safety review and evaluate available crash data to identify improvements required to mitigate guard, pedestrian, and driver safety concerns.
 3. Calculate existing and future lane requirements (per SDDCTEA Pamphlet 55-15, Traffic and Safety Engineering for Better Entry Control Facilities) with consideration of growth (BRAC, Grow the Army, etc), as well as single or tandem lane processing and automation (AIE, etc.).
 4. Utilize the ACP/ ECF SMART Decision Evaluator© (or other methods to accomplish the same results) to evaluate the existing, short-term and long-term impact of security, manpower, automation, and roads and traffic.
 5. Identify short-term recommendations.
 6. Identify long-term recommendations.
 7. Calculate threat requirements including AVB strategy per Department of the Army, Army Access Control Points Standard Design/Criteria.
 8. Identify traffic control requirements per SDDCTEA Pamphlet 55-15, Traffic and Safety Engineering for Better Entry Control Facilities.
 9. Consider conducting a comprehensive review of overall ACP needs (number of ACPs, optimum ACP locations, total lanes, roadway infrastructure requirements, origins/destinations) on the entire installation if improvements for multiple ACPs are being considered or if an existing ACP cannot be upgraded to meet requirements without technically infeasible infrastructure modifications.
- D. Siting. The ACP should be sited at a distance inside the installation to facilitate the queuing of vehicles without creating an off-post traffic problem, but spatially separated from inhabited buildings.

- E. Traffic Types. ACPs shall be capable of handling one or more of the following traffic types: trucks up to WB62, visitor POVs, DOD personnel POVs, official Army vehicles, pedestrians, and bicycles.
- F. Operation.
 - 1. To minimize problems associated with mixing of traffic types, a separate ACP should be identified as a Commercial Vehicle Only ACP.
 - 2. ACPs that must handle both commercial and passenger vehicles should provide separate commercial vehicle and passenger vehicle ID Check areas and separate search areas.
 - 3. ACPs that handle pedestrian traffic and vehicular traffic shall keep these traffic types physically separate.
- G. Future Enhancements. Designers shall consider future technology enhancements and possible expansion of the ACP. Automated systems to validate the identity of incoming personnel and vehicles are anticipated for use at Primary, Secondary, and Pedestrian ACPs. Designers shall provide spare conduits for communications, power, and computer upgrades.
- H. Coordination.
 - 1. Before designing an ACP, the designer shall coordinate with state and local authorities concerning impacts to public roadways, signage, and other requirements.
 - 2. Designers should coordinate with the Surface Deployment and Distribution Command (SDDC) for assistance on issues involving public highways.
 - 3. For OCONUS Installations, the designer should coordinate with the host nation government agencies or their appropriate Status of Forces Agreement (SOFA) subcommittee.
- I. The following requirements apply to Primary and Secondary ACPs except as noted: (Note, additional requirements for pedestrian access at Primary and Secondary ACPs are listed below in paragraph K below.)
 - 1. Performance Requirement. ACP's shall be designed to defeat all threats described below, to ensure safety of innocent users, and to maximize throughput.
 - 2. ACP Layout.
 - a. Corridor. The Access Control Point shall consist of a corridor at the installation boundary through which all vehicles and pedestrians must pass when entering or exiting the installation.
 - b. The perimeter of the ACP, except at its entrance, shall include both passive and active vehicle barriers arranged to form a contiguous barrier to vehicles. Active vehicle barriers, that can be opened and closed, shall be deployed at the end of the ACP (i.e., at the entrance to the Installation).
 - c. ACP guards will control the active vehicle barriers to deny or permit entry into the Installation.
 - d. Zones. The ACP corridor shall be divided into an Approach Zone, an Access Control Zone, and a Response Zone.
 - 1) The Approach Zone shall run from the ACP entrance to the beginning of the Access Control Zone. It shall provide an area for incoming vehicles to be sorted and queued for ID authentication.
 - 2) The Access Control Zone shall run between the Approach and Response Zones. Vehicle and occupant ID checks shall be performed within this zone at a covered ID Check Area or a covered Search Area.

- 3) The Response Zone shall run from the end of the Access Control Zone to the entrance to the Installation/Cantonment Area and includes the final active vehicle barriers.
3. Design Objective. The primary objective of the ACP design shall be to prevent an unauthorized vehicle or pedestrian from entering the installation. The ACP design shall include construction features supporting the effective and efficient use of equipment, manpower, and procedures to accomplish this primary objective.
4. Design Strategy. The overall design strategy to meet the objective above for vehicle threats shall be to detect the threat vehicle as early in its attack as possible and to delay it a sufficient amount of time to allow ACP guards time to deploy the active vehicle barriers before the threat vehicle can enter the Installation.
5. Design Criteria.
 - a. Vehicle Threat Scenarios. ACPs shall be designed to defeat the following four minimum vehicle threat scenarios. Additional vehicle threat scenarios may be considered if supported by a local threat assessment.
 - 1) Vehicle Threat Scenario #1. Threat vehicle enters the ACP in the inbound or outbound lane(s) at the maximum speed attainable at the ACP entrance and then immediately accelerates at its maximum acceleration rate through the ACP. Army policy sets the maximum acceleration rate of a threat vehicle at 11.3 f/s/s.
 - 2) Vehicle Threat Scenario #2. Threat vehicle enters the ACP in the inbound or outbound lane(s) at or under the posted ACP Speed Limit and then, later at some point further in the Approach Zone, accelerates at its maximum acceleration rate through the rest of the ACP.
 - 3) Vehicle Threat Scenario #3. Threat vehicle attempts to covertly enter the ACP, but is detected and denied entry by guards at the ID Check Area. Vehicle driver then defies guards and accelerates through the rest of the ACP at the vehicle's maximum acceleration rate.
 - 4) Vehicle Threat Scenario #4. Similar to Threat Scenario 3 above, except the driver of the denied vehicle drives toward the Turn-around or Search Area at the ACP Speed Limit (25mph) as if complying with guard instructions, but then fails to turn and instead accelerates at its maximum acceleration rate through the rest of the ACP.
 - b. Delay Time. Once a threat vehicle is detected, the ACP design shall delay it a sufficient time to allow ACP security guards time to deploy the active barriers before the threat vehicle reaches the entrance to the Installation. Delay time begins at the instant the attack is detected either by sensors or by security guards. The delay shall include the following:
 - 1) Guard reaction time shall be no less than 3 seconds for Threat Scenarios #1 through #3 and 1 second for Threat Scenario #4,
 - 2) Barrier traffic signal sequence time shall be no less than 4 seconds (unless other ACP features provide an equivalent amount of safety for innocent vehicles).
 - 3) Barrier operating time should not be more than 2 seconds.
 - 4) The ACP design, therefore, shall provide a minimum of 9 seconds delay for Threat Scenarios #1 through #3 and 7 seconds delay for Threat Scenario #4.

6. Entry Gate. The ACP entrance shall include a entry gate to close off the ACP at the installation perimeter. The entry gate shall provide the same level of security and same aesthetics as the adjoining perimeter barrier/fence.
7. ID Check Area. ACPs shall have an ID Check Area within the Access Control Zone where guards or automated means perform vehicle and passenger ID checks, grant vehicles authorization to enter the installation, or direct vehicles to other areas of the ACP.
8. ID Check Area Canopy. The ID Check Area shall be covered with a canopy over all inbound lanes to provide some protection from the weather for ID Check Area guards. The canopy shall meet the following requirements:
 - a. The canopy shall consist of a roof structure supported by columns.
 - b. Architectural treatment must reflect the architectural themes on the Installation and must also be consistent with architectural treatment of other facilities in the ACP, especially the gatehouse.
 - c. Canopy columns shall be sized to preclude the requirement for cross bracing below the roofline.
 - d. Columns shall be sized and located so as not to obstruct guard lines of site.
 - e. Roof underside shall be capable of supporting lighting fixtures and security equipment (e.g., CCTV cameras) anywhere on the underside of the roof and shall be treated with a reflective surface to help achieve required lighting levels and CCTV camera coverage.
 - f. Vertical clearance must be a minimum of 15 feet unless a large number of over height vehicles is expected, then 17 feet. Canopies at Truck/Commercial Vehicle only ACPs must have a minimum clearance of 17 feet.
 - g. Width shall be sufficient to cover all inbound lanes and all current and known future requirements for guard booths and the ID Check Area footprint.
 - h. Length shall be sufficient to cover single or tandem vehicle processing stations. New ACPs and existing ACPs with peak hourly demands greater than 300 vehicles per hour require tandem processing stations on each traffic island.
9. Entry Lanes.
 - a. The number of inbound and outbound lanes shall be determined from the Traffic Engineering Study.
 - b. ACPs shall have a minimum of 2 lanes in the ID Check Area.
10. Primary Traffic Islands. ACPs shall have raised, curbed islands to separate all inbound lanes in the ID Check Area.
11. Secondary Traffic Islands.
 - a. ACPs may also have raised, curbed islands at the end of the Approach Zone for installing over speed detectors or optional over height detectors.
 - b. When used, secondary islands should be the same width as primary islands.
12. Turn-around Lanes.
 - a. ACPs shall have at least two Turn-around Lanes, one before and one immediately after the ID Check Area.
 - b. If secondary islands are used, a Turn-around should be included between the secondary and primary islands.

13. Gatehouse. ACPs shall have a Gatehouse sized to accommodate ID Check Area guards and their activities. For new construction, the Gatehouse building shall be located on a raised island immediately after the last Turn-around to give the Gatehouse guard clear views of operations in the ID Check Area, of vehicles directed to the last Turn-around, and of vehicles entering and exiting the Search Area. At ACPs with existing Gatehouses, the Gatehouse building may be located within the ID Check Area. All Gatehouses shall have the following:
 - a. Construction to provide a minimum ballistics protection of UL 752 (latest edition) Level 3 with a higher level of protection authorized if warranted by a local threat assessment.
 - b. Heating and/or Air Conditioning appropriate for the geographic location,
 - c. Water Cooler.
 - d. Unisex Latrine with sink.
 - e. Interior storage for cleaning materials and special equipment.
 - f. Exterior storage for traffic cones, signs, etc.
 - g. Heavy-duty exterior power outlets sufficient to run temporary floodlights, etc.
 - h. Interior power outlets sufficient for radio chargers, computers, etc.
 - i. Active vehicle barrier control console with enunciator, computer workstation, and communications equipment including LAN, telephone, and Internet connections.
 - j. Sufficient counter space for report writing and storage of reference material.
 - k. Sufficient parking to facilitate security vehicle stationing and shift changes.
 - l. Passive barriers to provide crash protection from inbound and (if located on center island) outbound vehicles.
 - m. Windows to provide 180 degree field of view toward incoming traffic and mirrors or other visual aids to complete the field of view.
 - n. Electrical/communications room at least 10' by 10'.

14. Guard Booths. ACPs shall have a Guard Booth building for each lane of incoming traffic (except for the lane with a Gatehouse) for use by guards performing vehicle/passenger ID checks. Guard Booths shall be located on the primary, raised traffic islands or between raised traffic island sections in the ID Check Area. Guard Booths shall also have:
 - a. Construction that provides a minimum ballistics protection of UL 752 (latest edition) Level 3 with a higher level of protection authorized if warranted by a local threat assessment.
 - b. Heating and/or Air Conditioning appropriate for the geographic location.
 - c. Exterior power outlet sufficient to power hand-held searchlights, bug zappers etc.
 - d. Interior power outlet sufficient for radio chargers, computers, etc.
 - e. Active vehicle barrier control console with enunciator, computer workstation, and communications equipment including Local Area Network (LAN), telephone, and Internet connections.
 - f. Anti-fatigue floor mat.
 - g. Sufficient counter space for report writing and storage of reference material.
 - h. Passive barriers to provide crash protection from vehicles.
 - i. Windows to provide 360-degree field of view.

15. Passenger Vehicle Search Area. ACPs will have a Passenger Vehicle Search Area:
 - a. Covered with a canopy.
 - b. Easily assessable from the ID Check Area.
 - c. Shielded from casual observation from the ID Check Area.
 - d. Sized to accommodate the search of a minimum of 2 passenger vehicles.

16. Truck Search Area. ACPs that allow truck traffic will have a Truck Search Area:
 - a. Separate from the Passenger Vehicle Search Area.
 - b. Covered with a canopy (unless prohibited by the cargo search equipment system in use).
 - c. Obscured from casual observation.
 - d. Sized to accommodate the search of one WB-62 tractor-trailer and the search equipment to be used, e.g., Mobil Vehicle Inspection System (MVIS).
 - e. If there is only one Search Area for both trucks and passenger vehicles, the Search Area shall be easily assessable from the ID Check Area.

17. Search Offices. The ACP shall include a Search Office building located adjacent to both the Passenger Vehicle and Truck Search Areas to support Search Area guards and their activities. If Truck and Passenger Vehicle Search Areas are far apart, provide a Search Office for each. The size of the Search Office building shall be based on the volume of traffic expected through the ACP. As a minimum, the Search Office shall provide shelter for vehicle occupants during searches and storage of Search Area equipment. For ACPs with significant traffic volumes, each Search Area building will have:
 - a. Heating and Air Conditioning appropriate for the geographic location.
 - b. Water cooler.
 - c. Unisex Latrine with sink.
 - d. Internal storage for security equipment, supplies, and spare parts.
 - e. External storage for traffic control devices, vehicle inspection equipment, etc.
 - f. Locker storage for weapons, personal gear, and pre-positioning of protective equipment.
 - g. Break room for 4 security personnel with refrigerator, microwave, water cooler, and sink.
 - h. Space and power for Computer servers for future automated systems.
 - i. Interior power outlets sufficient for radio chargers, computers, etc.
 - j. Control console with enunciator controls for gate arms, aids to search guards (e.g., CCTV monitors), and communications equipment including LAN and Internet connections.
 - k. Secure and Non-secure areas for vehicle drivers and passengers separated by a space suitable for a walk-through metal detector and x-ray package scanner if used.
 - l. Space for a future Computer Kiosk for self-registration of drivers/passengers located in the non-secure area.
 - m. One or two (depending on anticipated requirement) truck driver/passenger processing stations each with sufficient workspace for a computer, ID Badge making machine, and camera for taking ID Photos.
 - n. Requirements for support of package and personnel screening devices, such as x-ray machines and magnetometers, if used.

18. Overwatch Position. ACPs shall have a strategically placed Overwatch Position located near the final active vehicle barriers but within sight of the ID Check Area. The Overwatch Position shall include a permanent facility or a paved pad to accommodate a security force vehicle or temporary facility during increased FPCONS. The position shall be equipped with controls for the active vehicle barriers.
 - a. Permanent Building. If a permanent building is provided, it shall provide a fighting position for one guard and shall include the following:

- 1) Construction to provide a minimum ballistics protection of UL 752 (latest edition) Level 3 with a higher level of protection authorized if warranted by a local threat assessment.
 - 2) Heating and/or Air Conditioning appropriate for the geographic location.
 - 3) Interior power outlet sufficient for radio chargers, computers, etc.
 - 4) Active vehicle barrier control console with enunciator, computer workstation, and communications equipment including Local Area Network (LAN), telephone, and Internet connections.
 - 5) Windows to provide 360-degree field of view.
- b. Paved Pad. If the Overwatch position is established as a paved pad for a temporary facility, a lockable junction box shall be imbedded in the pad with quick connections to communications, power, and barrier controls.

19. Passive Barriers. Passive vehicle barriers shall be capable of stopping a 15,000-pound vehicle traveling at the maximum speed and approach angle it can attain immediately prior to impacting the barrier. Where possible, the roadway shall be designed to limit the maximum approach angle to no more than 25 degrees. However, for other points on the perimeter, e.g., opposite to a Turn-around, the maximum approach angle could be as high as 90 degrees. Barriers at these points shall be sized accordingly.

20. Active Barriers.

- a. Number. Active barriers shall be installed in all inbound and outbound lanes at the end of the Response Zone.
- b. Vehicle Crash Resistance Capability. Active vehicle barriers shall be capable of stopping a 15,000-pound vehicle traveling at the maximum speed it can attain before impacting the barrier, but in no case shall the speed be less than 30 mph. The maximum vehicle speed must be determined by an evaluation of the threat vehicle speed and acceleration characteristics and the design of the roadway approaching the barrier. The allowable length of vehicle penetration beyond the barrier shall be determined by a local vulnerability assessment of buildings and facilities adjacent to the barrier that would be subjected to the detonation of the threat vehicle explosive charge. Active barriers shall have both an impact condition rating (weight of vehicle and impact speed) and a penetration rating (distance vehicle penetrates past the barrier). Active barriers shall have an impact condition rating for a 15,000-pound vehicle impacting the barrier at the speed determined above (but no less than 30 miles per hour) and a penetration rating equal to or greater than the allowable length of vehicle load penetration determined above. A larger vehicle weight may be used if warranted by a local threat/vulnerability assessment.
- c. Certification/Rating. Active vehicle barriers shall be:
 - 1) Included on the list of U.S. Department of State Certified Anti-Ram Vehicle Barriers, or
 - 2) Included on the list of DOD Certified Anti-Ram Vehicle Barriers maintained by the Protective Design Center.

Both the DOS and DOD certified anti-ram vehicle barrier lists are available on the PDC website <https://pdc.usace.army.mil/library/BarrierCertification>.
- d. Operating Modes: Active vehicle barriers shall be capable of either or both of the following modes of operation:
 - 1) Normally Open Mode. In the Normally Open mode, the barrier is open to normal traffic flow. Security guards will close the barriers only when they detect a threat vehicle. The design of the ACP for this mode of operation

- shall provide a sufficient delay after the threat vehicle is detected to allow the guards to close the barrier before the threat vehicle reaches it.
- 2) Normally Closed Mode. In the Normally Closed mode, the barrier is closed to normal traffic flow. Security guards will open it for each authorized vehicle and then immediately close it once that vehicle has passed over the barrier. This mode of operation adds time to process vehicles and creates additional wear and tear on the barriers. However, it significantly reduces the real estate required for the ACP by eliminating the requirement to delay the threat vehicle.
- e. Emergency Fast Operating Time. Active vehicle barriers deployed in the Normally Open operating mode shall have an Emergency Fast Operating (EFO) control capability. The EFO control shall be capable of closing the barrier in two (2) seconds or less when actuated.
 - f. Barrier Safety. Active vehicle barrier safety features shall ensure safety of innocent (non-threat) vehicles using the ACP in the event that the barrier is activated. One of the following Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) approved safety regimes shall be implemented:
 - 1) Option 1 – Signs and Signals Safety System. Active barriers shall be deployed in the Normally Open mode. ACP guards will activate all barriers simultaneously when a threat vehicle is detected. A traffic signal(s) shall be installed at the active vehicle barriers. During normal operation, the traffic signal shall indicate solid green or flashing yellow. When the guards initiate the barrier EFO command, the traffic signal shall change to solid yellow for a minimum of 3 seconds and then change to red. After a minimum of another 1 second, the barrier “close” circuit shall then be energized. The total delay of 4 seconds will give innocent vehicles approaching the barrier time to either clear the barrier or stop safely in front of it.
 - 2) Option 2 – Presence Detection Safety System. Active barriers shall be deployed in the Normally Open mode. ACP guards will activate all barriers simultaneously with the EFO command when a threat vehicle is detected. A traffic signal and stop line shall be installed in front of each active barrier. Vehicle presence detectors (VPDs) shall also be installed ahead of the stop line, between the stop line and the active barrier, and behind the active barrier. The traffic signal shall normally be red, requiring all vehicles to stop at the stop line. When the VPDs ahead of the stop line sense a vehicle for more than 1 second, the traffic signal shall change to green allowing the vehicle to proceed over the barrier. If the barrier EFO command is activated while a vehicle is in the zone of one of the VPDs between the stop line and the barrier or the VPDs behind the barrier, the barrier “close” circuit for that barrier shall be suppressed until the vehicle clears the zone. The other barriers shall not be affected and shall close instantaneously, unless a vehicle is also in their presence detector’s zone. This safety system will allow the elimination of the 4-second safety time delay described in Option 1 above. This safety system also requires passive barriers between all lanes (both inbound and outbound), which shall extend from the VPD’s in front each barrier to the VPD’s behind each barrier to prevent the threat vehicle from changing lanes from a closed barrier to an open barrier.
 - 3) Option 3 – Barrier Normally Closed Safety System. Active barriers shall be deployed in the Normally Closed mode. One set of Active Vehicle Barriers shall be installed in each inbound and outbound lane. Each set of barriers shall consist of an initial and final barrier separated by a selected

distance to form an entrapment area. Either the initial barrier or final barrier shall always be closed. Initial and final barriers are alternately opened and closed by guards to admit one or more authorized vehicles into the entrapment area and then to release them into the Installation (or vice-versa). VPDs immediately ahead of and behind each barrier shall suppress barrier closure until both VPDs are clear. Since there is always a closed barrier in the path of a threat vehicle, features to delay the threat vehicle are not required.

- 4) Other systems approved by SDDCTEA that provide an equivalent level of safety.
- g. Barrier Controls – Signs and Signals Safety System and Presence Detection Safety System.
- 1) Only guards in the Gatehouse, Guard Booths, Overwatch Position, and possibly the Search Area shall have emergency fast operate (EFO) control of the active barriers. An EFO button shall be provided on a barrier Master Control Panel located in the Gatehouse. An EFO button shall also be located on a Control Panel in each Guard Booth, the Overwatch Position, and the Search Area (if required). Actuation of any EFO button shall close all active barriers in all inbound and outbound lanes.
 - 2) The barrier Master Control Panel, each Guard Booth Control Panel, and the Search Area Control Panel (if required) shall include an enunciator providing audible and visual indication of alarms including over speed and wrong way alarms.
 - 3) Switches and indicating lights shall be provided on the barrier Master Control Panel to allow the Gatehouse guard to enable or disable the individual EFO buttons in the Guard Booths, Overwatch Position, and Search Area (if required).
 - 4) Indicating lights shall be provided on the Guard Booth, Overwatch Position, and Search Area (if required) control panels showing whether the EFO switch on the control panel is enabled or disabled. A separate indicating light on these control panels shall also indicate if the EFO has been actuated. Indicating lights may also be provided on these control panels that indicate the OPEN and CLOSE positions of each barrier.
 - 5) The Master Control Panel shall include a key operated LOCAL-EFO-TEST mode selector switch, OPEN and CLOSE control switches, and OPEN and CLOSE status indication for each barrier. The mode selector switch will allow the lead ACP guard to switch to LOCAL mode (open and normal close control only at the barrier), TEST mode (open and normal close control only from the Master Control Panel), and EFO mode (emergency fast closure control from any of the EFO switches).
 - 6) The Master Control Panel shall also include a key operated EFO RESET switch to reset EFO after it has been initiated.
 - 7) Under normal operations, keys for each barrier's mode selector switch and the EFO Reset switch shall be removed from the switches and controlled by the lead ACP guard.
- h. Barrier Controls – Barrier Normally Closed Safety System.
- 1) Guards shall control barriers from either the Gatehouse or Guard Booths.
 - 2) A Gatehouse Master Control Panel shall be located in the Gatehouse and shall include the following:
 1. Key operated LOCAL-AUTO-MANUAL mode selector switch for each barrier set (initial and final barriers).
 2. FILL and RELEASE control switches for each barrier set for operation in the AUTO mode.

3. OPEN and CLOSE switches for each individual barrier for operation in the MANUAL mode.
 4. OPEN and CLOSE status indicating lights for each individual barrier.
- 3) A Guard Booth Control Panel shall be provided for each Guard Booth and shall include the following:
1. FILL and RELEASE control switches for each barrier set for operation in the AUTO mode.
 2. OPEN and CLOSE status indicating lights for each individual barrier.
- 4) Strict key control must be maintained to prevent ACP guards from operating barriers in the LOCAL or MANUAL modes unless supervised by the head of the ACP guards.
21. Visitors Control Center (VCC). For ACPs that handle visitors, the ACP shall have a Visitors Control Center building for processing visitors wishing to enter the installation. The VCC should be sized for effective through put of the number of expected visitors considering that a single processor can process 12-20 visitors per hour. The Visitors Control function for ACPs with minimal visitors can be performed from a Guard Booth; a separate VCC building is not required. The VCC should include the following:
- a. Waiting Area.
 - b. Parking.
 - c. Service Counter.
 - d. Self-registering kiosks.
 - e. Administration Office.
 - f. Break Room.
 - g. Water cooler.
 - h. Restrooms.
22. Lighting. ACP lighting will meet the following criteria:
- a. Approach and Response Zones and Search Area Parking and Roadways – 3 Foot Candles (FC) average with average to minimum ratio not to exceed 4:1.
 - b. Access Control Zone and Search Areas – 5 FC average with average to minimum ratio not to exceed 3:1. In the location where ID checks or searches are made, illumination shall be 10 FC or twice the illumination in the immediate surrounding area (whichever is greater). The vertical illumination shall be at least 25% of the horizontal illumination.
 - c. Lighting at the ID Check and Search Areas shall have a color rendition index (CRI) of not less than 65. All other light sources shall have a CRI of not less than 50.
23. Surveillance. ACPs will have a CCTV system with the following:
- a. Overwatch Cameras. CCTV cameras shall over watch the Approach Zone, ID Check Area, Search Area, and Active Vehicle Barrier areas.
 - b. ID Check Area. CCTV cameras shall be positioned to view driver, ID Check guard, and the vehicle in the ID check lane.
 - c. Search Areas. CCTV cameras shall be positioned to view drivers, Search guards, and the vehicle being searched.
 - d. Rear License Plates. Conduit shall be installed in the islands at the ID Check Area and Search Areas to accommodate future cameras to view rear license plates.
 - e. Monitors. Monitors for CCTV shall be at the Gatehouse and the Central Security Monitoring Station.

- f. Digital Video Recording. The CCTV system shall include digital video recording for all ACP video cameras. The video recording shall operate 24 hours per day, 7 days a week and shall retain all imagery for a minimum of 7 days.
24. Communications. Guards at the Gatehouse, Guard Booths, Search Areas, Overwatch Position, and Visitors Control Center shall have a minimum of 2 means of communications with each other and with the Central Security Monitoring Station.
25. Information Access. ACPs shall have computers capable of accessing and displaying pertinent law enforcement information and Installation access data.
26. Electronic Security.
- a. Duress Alarms. Guards at the ID Check Area, Search Areas, Overwatch Position, and VCC will have duress alarm capability that will annunciate at both the Gatehouse and the Central Security Monitoring Station.
 - b. Intrusion Detection. The entry doors to the Gatehouse, Guard Booths, Overwatch Building, Search Office, and Visitors Control Center shall be equipped with Balanced Magnetic Switches (BMS) for intrusion detection.
 - c. Tamper Switches.
 - 1) Electronic control cabinets for communications, security, and barrier controls shall be equipped with tamper switches.
 - 2) The junction box at the Overwatch Position pad (if provided) shall be equipped with a tamper switch.
27. Back-up Power. The ACP will have a back-up emergency generator or equivalent with the following:
- a. Automatic start-up within 10 seconds after the normal source of electrical power fails.
 - b. Sufficient on-site fuel to maintain full-load operation for a minimum of 12 hours.
 - c. Status monitored at Gatehouse including alarms for loss of normal power, emergency generator malfunction, and low fuel.
 - d. The following loads shall be on Back-up Power:
 - 1) Interior lighting for the Gatehouse, Guard Booths, Overwatch position, and Inspection Offices.
 - 2) Canopy lighting in the ID Check Area and the Search Areas.
 - 3) External lighting in the Access Control Area.
 - 4) External lighting in the Search Areas.
 - 5) Approach Zone and Response Zone lighting within 100 feet of the Access Control Zone.
 - 6) External lighting 150 feet on both sides of the final vehicle barriers.
 - 7) Uninterruptible Power Supplies (UPS).
28. Uninterruptible Power Supply (UPS). The ACP shall have one or more Uninterruptible Power Supplies to power critical security and safety loads. The UPS(S) shall be sized to carry its required load(s) for a minimum of 10 minutes when the normal source of electrical power fails. The following loads shall be on UPS:
- a. Primary communications system
 - b. Duress alarm system.
 - c. Computers.

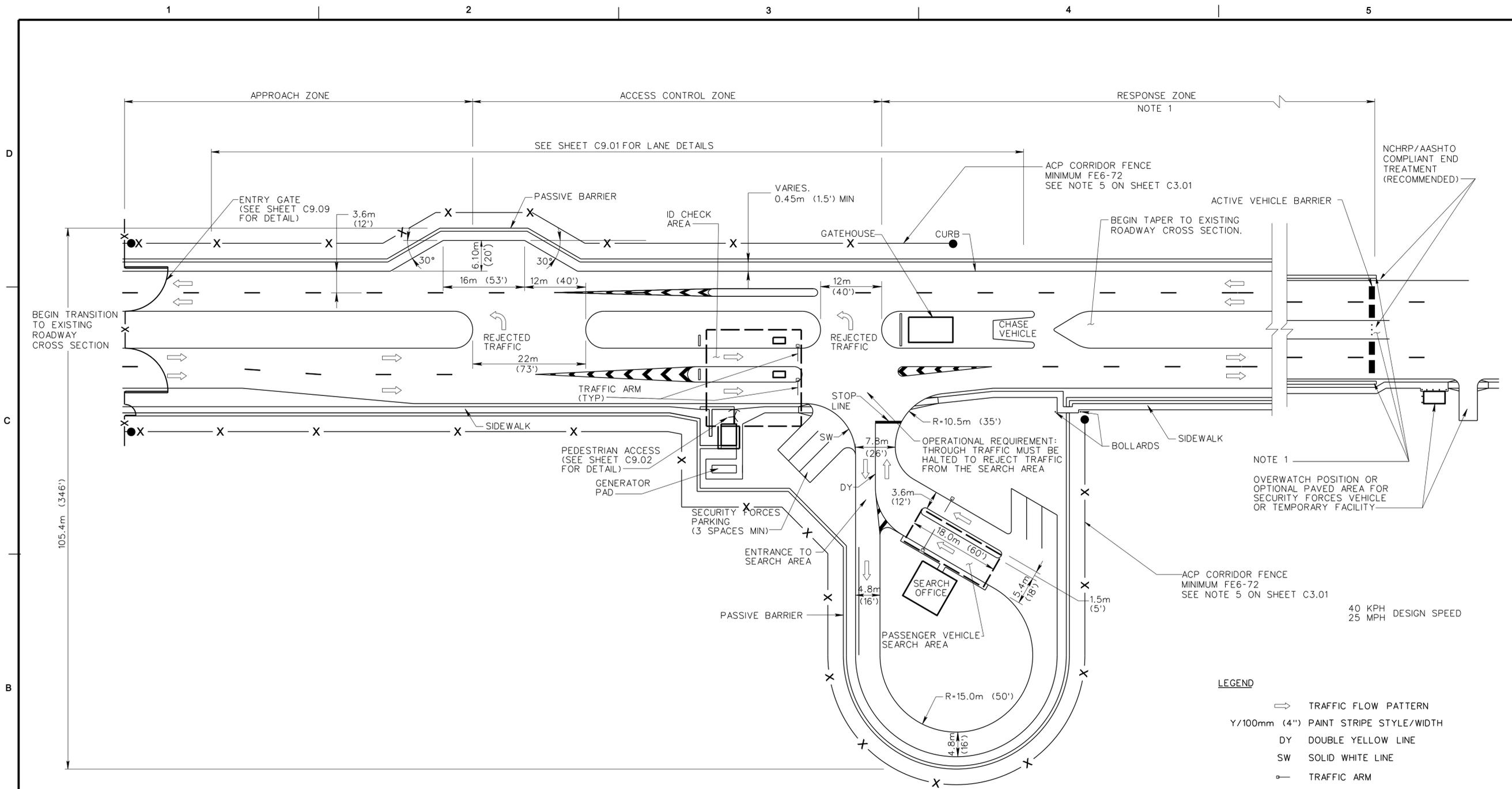
- d. CCTV systems.
 - e. Intrusion Detection Systems (IDS).
 - f. Lighting:
 - 1) One luminaire for each ID Check Lane located near the guard position.
 - 2) One luminaire for each CCTV camera required at the Active Vehicle Barrier.
 - g. Access Control Equipment including:
 - 1) Active vehicle barrier controls,
 - 2) Active barrier activation system for one complete operation cycle (open to close and close to open).
 - 3) Traffic arms.
 - 4) Traffic sensors (wrong way, over speed, and presence detectors).
 - 5) Traffic signals and warning lights.
29. Traffic Control Devices.
- a. ACPs shall utilize traffic control devices including signs, markings, signals, and traffic arms to direct traffic, to provide information, and to safeguard both drivers and guards.
 - b. Traffic control devices shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), the National Standard IAW Title 23 U.S. Code, and applicable State and Host-Nation laws.
 - c. The Surface Deployment and Distribution Command, Transportation Engineering Agency (SDDCTEA) is available to assist in defining traffic control requirements when standards are not available.
 - d. An Overheight Vehicle Detection and Warning System should be deployed ahead of the ID Check Area to detect and warn drivers of Overheight vehicles before proceeding to the canopy.
30. Automation: Personnel identification systems for automated access control shall be compatible with approved DOD identification credentials.
- J. The following requirements apply to Limited Use ACPs:
- 1. Entry Gate. The ACP entrance shall include an entry gate to close off the ACP at the Installation perimeter.
 - 2. The entry gate shall provide the same level of security and same aesthetics as the adjoining perimeter barrier/fence.
- K. The following requirements apply to Pedestrian ACPs. These requirements apply to Pedestrian ACPs that stand-alone or Pedestrian ACP facilities that are a part of a Primary or Secondary ACP. The term pedestrian used here includes both pedestrian and bicycle traffic.
- 1. Performance Standard. Pedestrian ACPs shall be designed to prevent unauthorized entry, to ensure safety, and to maximize throughput of pedestrians.
 - 2. Design Criteria. Pedestrian Threat Scenarios. ACPs shall be designed to defeat the following two minimum pedestrian threat scenarios. Additional threat scenarios may be considered if supported by a local threat assessment:
 - a. Pedestrian Threat Scenario #1. Pedestrian attempts to forcibly enter the Installation by breaching or circumventing ACP barriers using limited hand tools.
 - b. Pedestrian Threat Scenario #2. Pedestrian attempts to covertly enter the Installation by using false credentials.

3. Entry Gate. Pedestrian ACPs will have an Entry Gate at the ACP entrance capable of closing off the ACP. The Entry Gate shall provide equivalent security and equivalent aesthetics as the adjoining perimeter fence/barrier.
4. Guard Booths. Pedestrian ACPs will have one or more Guard Booth buildings for use by guards performing pedestrian ID checks. Guard Booths will have the following:
 - a. Construction that provides a minimum ballistics protection of UL 752 (latest edition) Level 3 with a higher level of protection authorized if warranted by a local threat assessment.
 - b. Heating and/or Air Conditioning appropriate for the geographic location.
 - c. Exterior power outlet sufficient to power hand-held searchlights, bug zappers, etc.
 - d. Interior power outlets sufficient for radio chargers, computers, etc.,
 - e. Anti-fatigue floor mat.
 - f. Sufficient counter space for report writing and storage of reference material.
 - g. Windows to provide a 360-degree field of view.
5. Perimeter Barriers. Pedestrian ACPs shall have passive barriers along each side of the ACP corridor capable of preventing easy penetration by a pedestrian. These barriers must tie into the Entry Gate at the ACP entrance as well as the Active Pedestrian Barrier(s) to form a contiguous personnel barrier from the ACP entrance through the Active Pedestrian Barrier(s).
6. Active Pedestrian Barriers. Pedestrian ACPs shall include active pedestrian barriers (e.g., turnstiles, portals, etc.) controlled by the ACP guards to regulate pedestrian traffic.
7. Communications.
 - a. ACP guards shall have a minimum of two means to communicate with each other and with guards at the Gatehouse (if the pedestrian access is part of a Primary or Secondary ACP) or guards at the Central Security Monitoring Station (if the Pedestrian ACP is Stand-alone).
 - b. ACP guards will have wireless duress alarms that annunciate at the Gatehouse (if the pedestrian access is part of a Primary or Secondary ACP) or the Central Security Monitoring Station if the Pedestrian ACP is Stand-alone).
8. Lighting. Lighting in the Pedestrian ACP shall maintain a minimum of 2-foot candles illumination.
9. Surveillance Equipment. Pedestrian ACPs shall be equipped with a Closed Circuit Television (CCTV) system with the following requirements:
 - a. Overwatch Cameras. CCTV cameras shall over watch the approach to the Guard Booth from the Entry Gate to the area around the active pedestrian barrier including the Guard Booth.
 - b. Monitors. Monitors for CCTV shall be at the Pedestrian Guard Booth. Monitors shall also be at the Gatehouse if the Pedestrian ACP is part of a Primary or Secondary ACP or at the Central Security Monitoring Station if the Pedestrian ACP is stand-alone.
 - c. Digital Video Recording. The CCTV system shall include digital video recording for all ACP cameras. The video recording shall operate 24 hours per day, 7 days a week and shall retain all imagery for a minimum of 7 days.

10. Information Access. Pedestrian ACPs shall have a computer capable of accessing and displaying pertinent law enforcement information and Installation access data.
11. Signs. Pedestrian ACPs shall include signs to direct pedestrians, provide security information, and provide adequate safeguards to both guards and pedestrians.

APPENDIX C

DRAWINGS



NOTES:
 1. SEE APPENDIX D FOR METHOD TO DETERMINE DETECTION AND DELAY REQUIREMENTS INCLUDING THE LENGTH OF THE RESPONSE ZONE. SEE DWGS. C9.02 AND C9.03 FOR DETAILS OF THE PASSIVE AND ACTIVE VEHICLE BARRIER INTERFACES. SEE DWG. C9.10 FOR SIGNS AND SIGNALS REQUIRED FOR THE ACTIVE VEHICLE BARRIERS. SEE DWG. C9.13 FOR SIGN DETAILS AND TYPICAL LAYOUT. SEE DWG. C9.14 FOR PAVEMENT MARKING DETAIL.

PRIMARY/SECONDARY ACP WITHOUT VCC
 (NOT FOR COMMERCIAL VEHICLES)
 SCALE: 1:400

- LEGEND**
- TRAFFIC FLOW PATTERN
 - Y/100mm (4") PAINT STRIPE STYLE/WIDTH
 - DY DOUBLE YELLOW LINE
 - SW SOLID WHITE LINE
 - TRAFFIC ARM
 - ACTIVE VEHICLE BARRIER
 - ▬▬▬ PASSIVE VEHICLE BARRIER
 - xx— ORNAMENTAL FENCE
 - x— FENCE
 - BOLLARDS
 - CANOPY
 - ▭ BARRIER WALL
 - ▬▬▬ DOUBLE FACE GUARD RAIL
 - ▬▬▬ SINGLE FACE GUARD RAIL
 - ▭ GUARD BOOTH
 - ▭ GENERATOR PAD W/SIDEWALK
 - ▭ CURB RAMP

40 KPH
 25 MPH DESIGN SPEED

NO.	SYMBOL	DESCRIPTION	DATE	BY

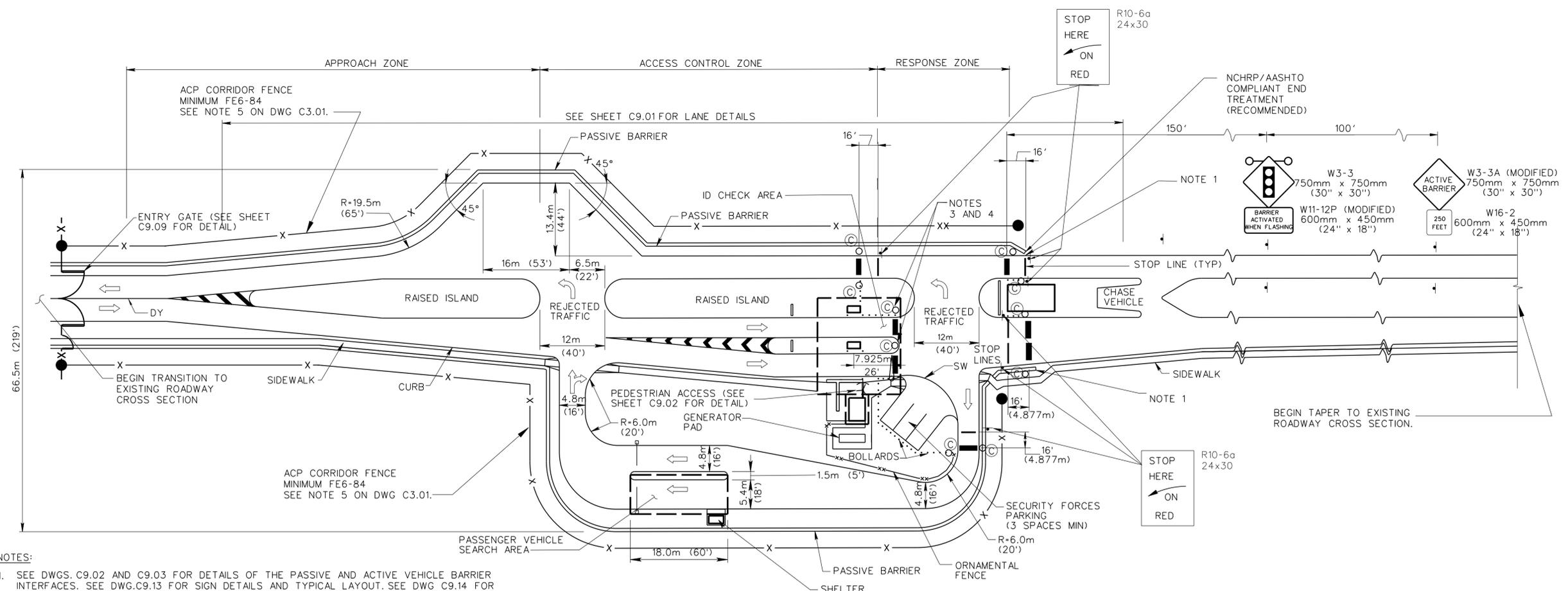
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FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANSI D	PLOT SCALE: 1:1
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U. S. ARMY ENGINEER DISTRICT
 CORPS OF ENGINEERS
 OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
 ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
 SITE PLAN
 PRIMARY/SECONDARY ACP WITHOUT VCC

SHEET REFERENCE NUMBER
C3.03
 SHEET 6 OF 60

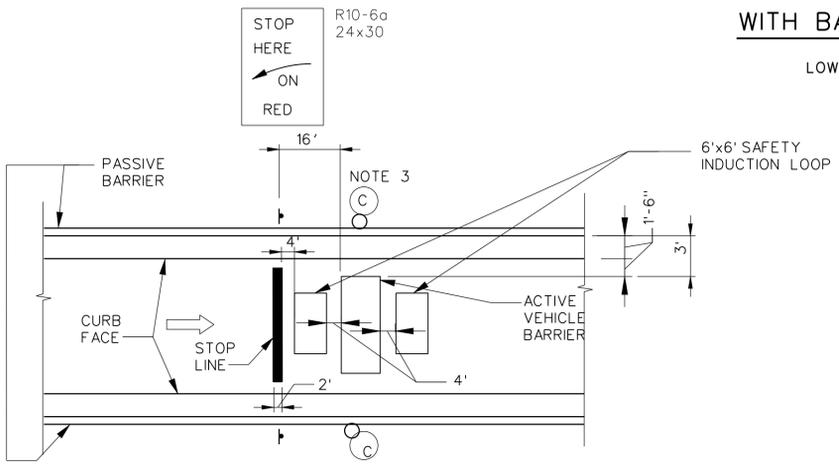
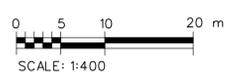
\$\$\$CONTRACTOR\$\$\$
 \$\$\$SYSTEMS\$\$\$
 \$\$\$USERNAME\$\$\$



- NOTES:**
- SEE DWGS. C9.02 AND C9.03 FOR DETAILS OF THE PASSIVE AND ACTIVE VEHICLE BARRIER INTERFACES. SEE DWG. C9.13 FOR SIGN DETAILS AND TYPICAL LAYOUT. SEE DWG. C9.14 FOR PAVEMENT MARKING DETAILS.
 - BARRIERS ARE NORMALLY CLOSED. ID CHECK AREA OR GATEHOUSE GUARD OPENS BARRIER FOR EACH INBOUND OR OUTBOUND VEHICLE AND THEN IMMEDIATELY CLOSES IT BEHIND THEM.
 - MOUNT TRAFFIC SIGNALS ON BOTH SIDES OF BARRIERS.
 - TILT TRAFFIC SIGNALS INWARD SUCH THAT THEY CAN BE SEEN ONLY FROM APPROPRIATE LANE.

RESTRICTED REAL ESTATE ACP WITH BARRIER NORMALLY CLOSED (DEPLOYED) OPERATION

NO COMMERCIAL VEHICLES ALLOWED
LOW VOLUME APPLICATIONS ONLY (NOT SUITABLE FOR > 400 VEHICLES PER HOUR)



SIGNALIZATION DETAIL FOR BARRIER NORMALLY CLOSED SAFETY SYSTEM

NOT TO SCALE

LEGEND

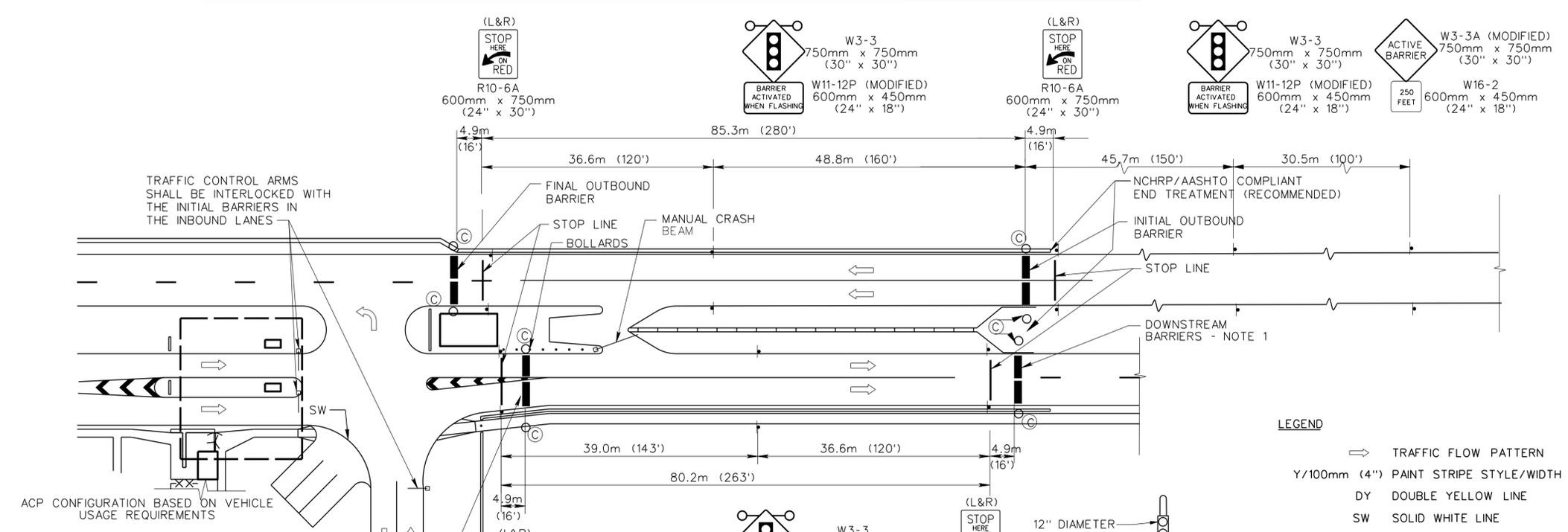
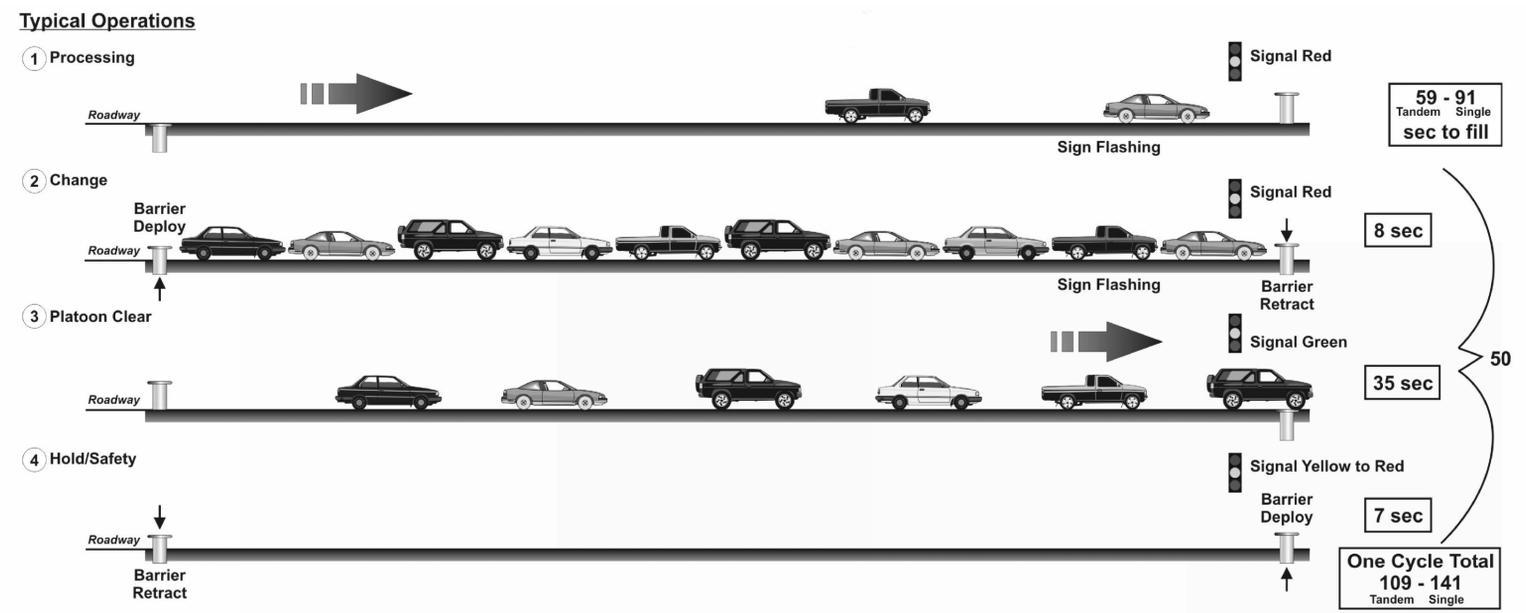
- TRAFFIC FLOW PATTERN
- Y/100mm (4") PAINT STRIPE STYLE/WIDTH
- DY DOUBLE YELLOW LINE
- SW SOLID WHITE LINE
- TRAFFIC ARM
- ACTIVE VEHICLE BARRIER
- ▬▬▬ PASSIVE VEHICLE BARRIER
- xx— ORNAMENTAL FENCE
- x— FENCE
- BOLLARDS
- CANOPY
- ▭ BARRIER WALL
- ▬▬▬ DOUBLE FACE GUARD RAIL
- ▬▬▬ SINGLE FACE GUARD RAIL
- GUARD BOOTH
- GENERATOR PAD W/SIDEWALK
- ▭ CURB RAMP
- TRAFFIC SIGNAL DETAIL

NO.	SYMBOL	DESCRIPTION	DATE	BY

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SUBMITTED BY:				
FILE NAME: X.X				
SIZE: ANSI D				
PLOT SCALE: 1:1				

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
SITE PLAN
RESTRICTED REAL ESTATE ACP
WITH BARRIER NORMALLY CLOSED (DEPLOYED) OPERATION



NOTES:

1. SEE DWG. C3.08 FOR SIGNS AND SIGNALS REQUIRED FOR ACTIVE VEHICLE BARRIERS. SEE DWGS. C9.02 AND C9.03 FOR DETAILS OF THE PASSIVE AND ACTIVE VEHICLE BARRIER INTERFACES. SEE DWG. C9.13 FOR SIGN DETAILS AND TYPICAL LAYOUT. SEE DWG. C9.14 FOR PAVEMENT MARKING DETAILS.

2. RESPONSE ZONE LENGTH VARIES WITH THE NUMBER AND TYPE OF VEHICLES TO BE QUEUED AND AVAILABLE REAL ESTATE. ADJUST SIGNS AND SIGN SPACING AS NECESSARY, BUT IN CONFORMANCE WITH THE MUTCD.

DESIGN PARAMETERS	RESPONSE ZONE	MAX THREAT SPEED WITH LANE DIVIDERS	PROS	CONS	APPLICABILITY/ CONSIDERATIONS
NORMAL CONDITIONS DESIGN SPEED - N/A Emax (SUPERELEVATION) = N/A R = N/A	N/A	N/A	MULTIPLE LINES OF SECURITY SINCE BARRIERS ARE UP OR DOWN IN A CONTROLLED SITUATION, MOTORISTS ARE MORE AWARE OF BARRIER DEPLOYMENTS	DECREASES TRAFFIC PROCESSING BY 38% FOR SINGLE PROCESSING AND 46% FOR TANDEM PROCESSING HIGHER COSTS DUE TO MORE BARRIERS AND INCREASED USAGE	FOR LOW TRAFFIC VOLUMES. SIZE ENTRAPMENT AREA FOR ANTICIPATED VOLUME.

- LEGEND**
- ⇒ TRAFFIC FLOW PATTERN
 - Y/100mm (4") PAINT STRIPE STYLE/WIDTH
 - DY DOUBLE YELLOW LINE
 - SW SOLID WHITE LINE
 - TRAFFIC ARM
 - ACTIVE VEHICLE BARRIER
 - PASSIVE VEHICLE BARRIER
 - ORNAMENTAL FENCE
 - FENCE
 - BOLLARDS
 - CANOPY
 - BARRIER WALL
 - DOUBLE FACE GUARD RAIL
 - SINGLE FACE GUARD RAIL
 - GUARD BOOTH
 - GENERATOR PAD W/SIDEWALK
 - CURB RAMP
 - ⊙ TRAFFIC SIGNAL DETAIL

VEHICLE PLATOONING

NOT TO SCALE

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

DESIGNED BY:	DATE:	SUBMITTED BY:	DATE:	FILE NAME:	PILOT DATE:	PILOT SCALE:	PILOT DATE:	PILOT DATE:	PILOT DATE:
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W15FH07X-604									

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS

PROTECTIVE SYSTEMS
VEHICLE PLATOONING

SHEET REFERENCE NUMBER
C3.16
SHEET 19 OF 60

55CONSREQS
55SYSTEMS
55USERNAME55

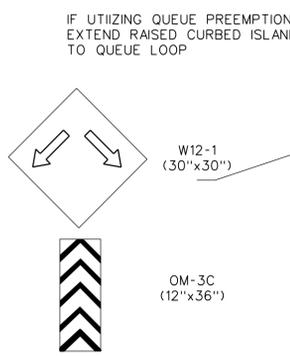
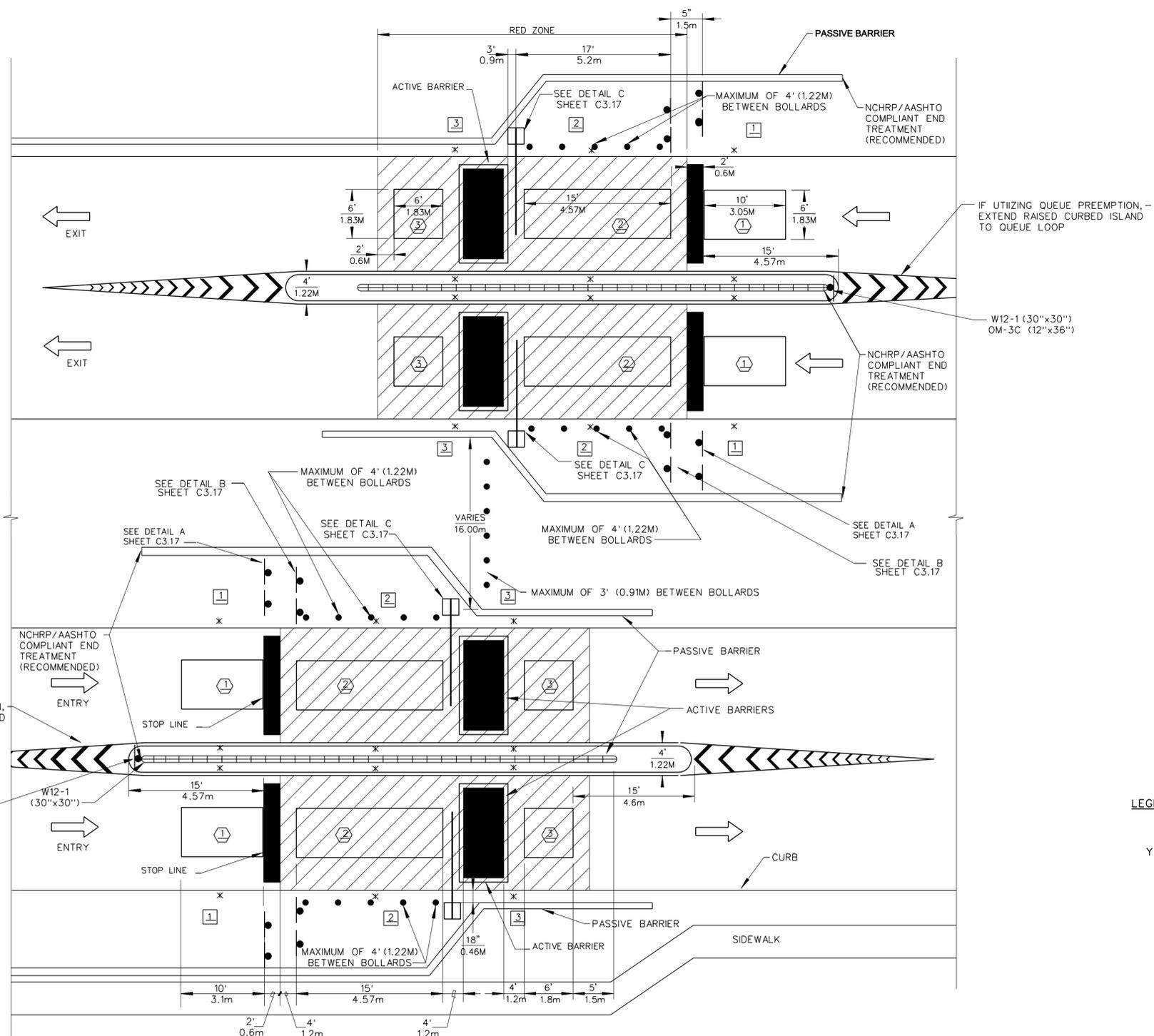
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U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
PROTECTIVE SYSTEMS
VEHICLE PRESENCE DETECTION
4-LANE DIVIDED PLAN

SHEET REFERENCE NUMBER
C3.18
SHEET 21 OF 60



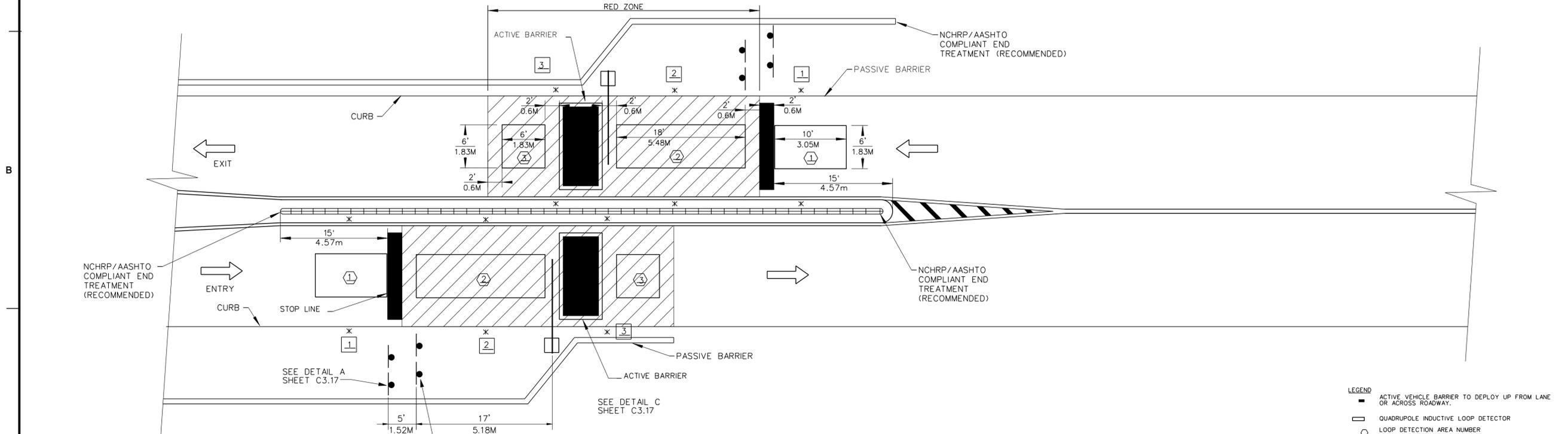
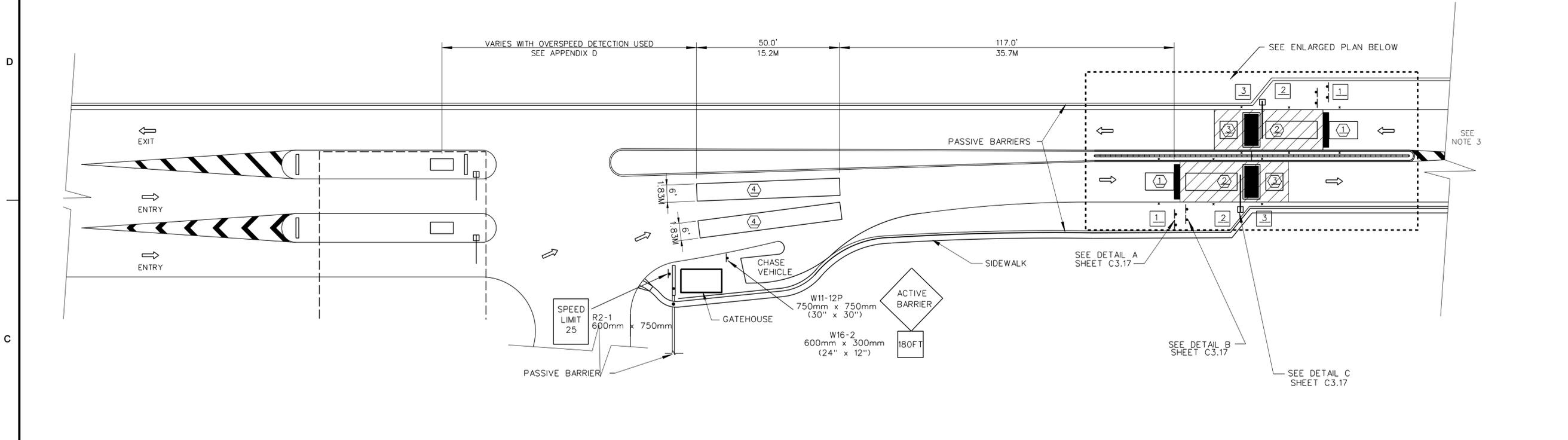
LEGEND

	TRAFFIC FLOW PATTERN
	Y/100mm (4") PAINT STRIPE STYLE/WIDTH
	DY DOUBLE YELLOW LINE
	SW SOLID WHITE LINE
	TRAFFIC ARM
	ACTIVE VEHICLE BARRIER
	PASSIVE VEHICLE BARRIER
	ORNAMENTAL FENCE
	FENCE
	BOLLARDS
	CANOPY
	BARRIER WALL
	DOUBLE FACE GUARD RAIL
	SINGLE FACE GUARD RAIL
	GUARD BOOTH
	GENERATOR PAD W/SIDEWALK
	CURB RAMP
	INDUCTION LOOP SENSOR
	BROOK BEAM SENSOR

PRESENCE DETECTION LAYOUT DETAILS
NOT TO SCALE

- NOTES:
- SEE DWGS. C9.02 AND C9.03 FOR DETAILS OF THE PASSIVE AND ACTIVE VEHICLE BARRIER INTERFACES. SEE DWG. C9.13 FOR SIGN DETAILS AND TYPICAL LAYOUT. SEE DWG C9.14 FOR PAVEMENT MARKING DETAILS.
 - LOOP DETECTORS SHALL NOT BE INSTALLED ACROSS THE TRANSITION IN PAVING MATERIALS WITHOUT APPROPRIATE PROTECTION.

\$\$\$CONSREQS\$\$\$
\$\$\$SYSTEMS\$\$\$
\$\$\$USERNAME\$\$\$



- NOTES:
- SEE DWGS. C9.02 AND C9.03 FOR DETAILS OF THE PASSIVE AND ACTIVE VEHICLE BARRIER INTERFACES. SEE DWG. C9.13 FOR SIGN DETAILS AND TYPICAL LAYOUT. SEE DWG. C9.14 FOR PAVEMENT MARKING DETAILS.
 - LOOP DETECTORS SHALL NOT BE INSTALLED ACROSS THE TRANSITION IN PAVING MATERIALS WITHOUT APPROPRIATE PROTECTION (AS DETERMINED BY PROJECT ENGINEER)
 - SEE SHEET C3.17 FOR DETAILS OF OUTBOUND QUEUE DETECTION IF REQUIRED.

LEGEND

- ACTIVE VEHICLE BARRIER TO DEPLOY UP FROM LANE OR ACROSS ROADWAY.
- QUADRUPOLE INDUCTIVE LOOP DETECTOR
- LOOP DETECTION AREA NUMBER
- BEAM DETECTION AREA NUMBER
- ↑ POST MOUNTED SIGN ON SHOULDER, LANE ISLAND, OR IN MEDIAN.
- ← TRAFFIC GATE ARM.
- * ELECTRONIC BEAM LANE SENSORS.
- ▨ RED ZONE.
- ⊗ INDUCTION LOOP SENSOR
- ⊠ BROOK BEAM SENSOR

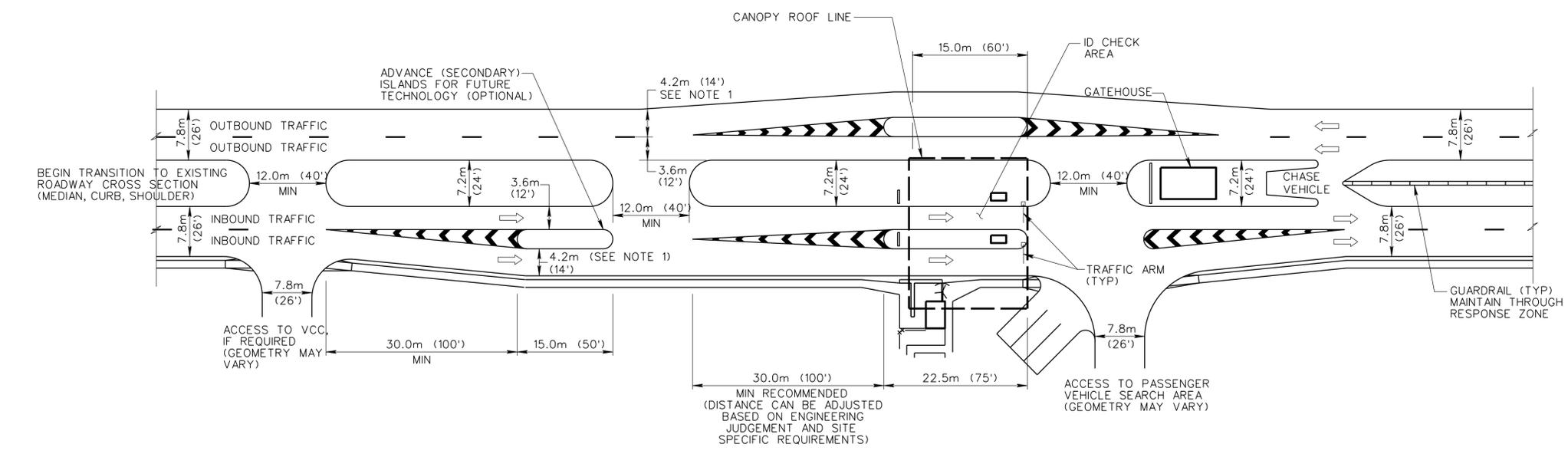
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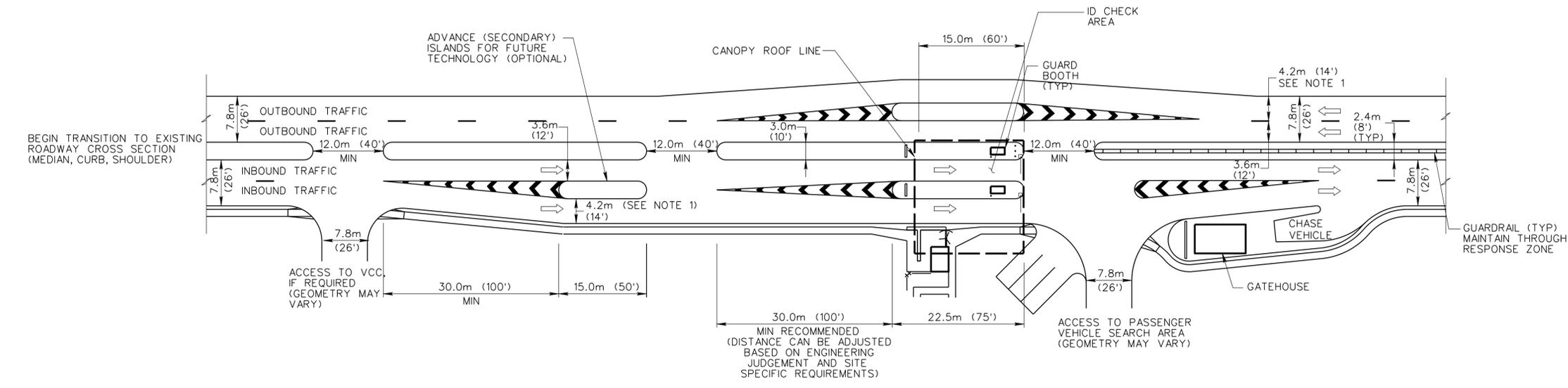
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
VEHICLE PRESENCE DETECTION 2-LANE PLAN

SHEET REFERENCE NUMBER
C3.19
SHEET 22 OF 60

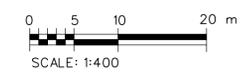


ACCESS CONTROL ZONE -
MEDIAN GATEHOUSE LANE DETAILS



ACCESS CONTROL ZONE -
RIGHT SHOULDER GATEHOUSE LANE DETAILS

NOTES:
1. LANE SHOULD BE 3.6m (12') WIDE, PLUS 0.6m (2') FOR CURB & GUTTER. PROVIDE 5.1m (17') TO ACCOMMODATE BICYCLE ACTIVITY IF APPROPRIATE.



NO.	SYMBOL	DESCRIPTION	DATE	BY

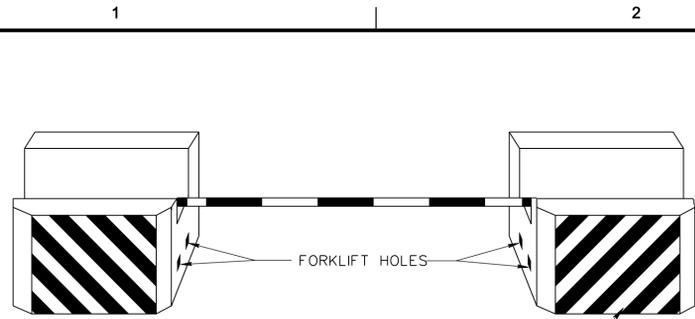
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SIZE: ANS/D	PLOT DATE:
SCALE: 1:1	

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
SITE PLAN
ACCESS CONTROL ZONE DETAILS

SHEET REFERENCE NUMBER
C9.01
SHEET 23 OF 60

\$\$\$CONSPR04S
\$\$\$SYSTEMS
\$\$\$USERNAME\$\$\$

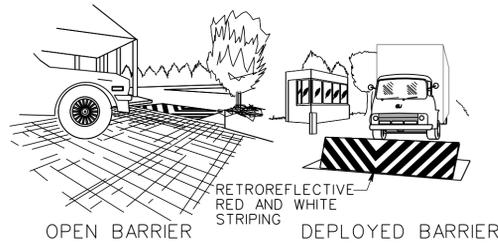


BARRIER RATING: K-4
 OPERATION: TRANSPORTABLE VEHICLE BARRIER,
 MANUAL OR HYDRAULIC OPERATION.

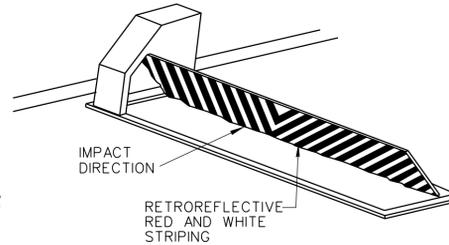
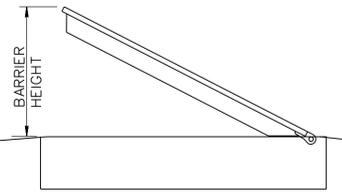
RETROREFLECTIVE
 RED AND WHITE
 STRIPING (TYP)

TRANSPORTABLE ACTIVE VEHICLE BARRIER

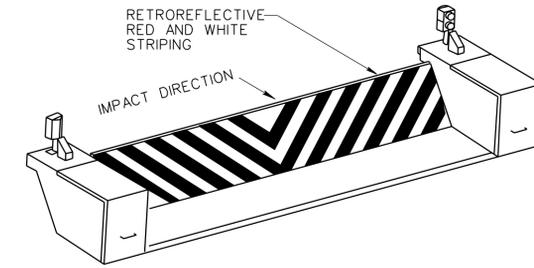
NOT TO SCALE



OPEN BARRIER DEPLOYED BARRIER

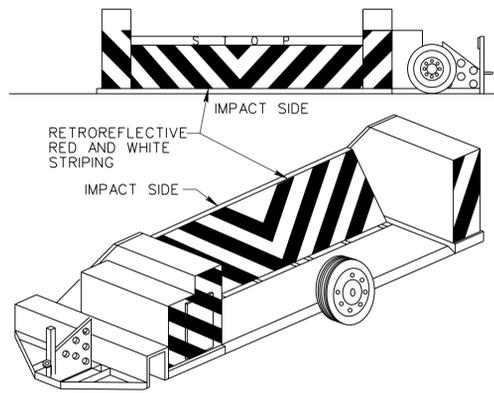


BARRIER RATING: K4, K8, K12
 OPERATION: RAMP RISES FROM A RECESS IN THE
 ROADWAY



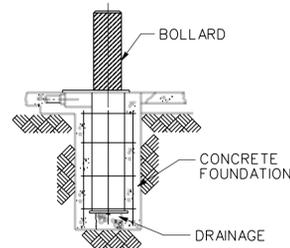
SHALLOW FOUNDATION AND SURFACE MOUNT BARRIERS

NOT TO SCALE

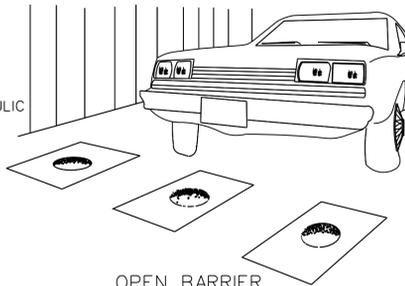


BARRIER RATING: CONDITION DESIGNATION K4 & K12
 OPERATION: PORTABLE VEHICLE BARRIER, N & D MODELS CAN BE
 SPECIFIED FOR MANUAL OR HYDRAULIC OPERATION

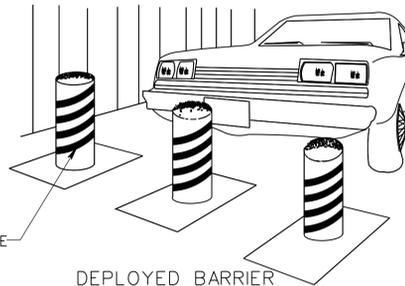
BARRIER RATING: K4, K8, K12
 OPERATION: THE BOLLARDS RISE FROM
 THE ROADWAY
 COMMENT: DEPLOYMENT SPEED VARIES WITH HYDRAULIC
 OR PNEUMATIC OPERATORS



RETROREFLECTIVE
 RED AND WHITE
 STRIPING



OPEN BARRIER



DEPLOYED BARRIER

BOLLARDS

NOT TO SCALE

REFERENCE MATERIAL:

DEPARTMENT OF STATE AND DEPARTMENT OF DEFENSE LIST OF CERTIFIED ANTI-RAM
 VEHICLE BARRIERS (<https://pdc.usace.army.mil/library/BarrierCertification/>)

UFC 4-020-01/UFC 4-020-02 SECURITY ENGINEERING PLANNING AND DESIGN MANUALS

UFC 4-022-01 ENTRY CONTROL FACILITIES/ACCESS CONTROL POINTS

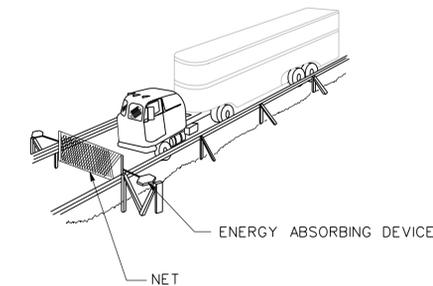
UFGS 34-71-13-19 ACTIVE BARRIERS SPECIFICATIONS

UFGS 34-41-26.00 10 2 ACCESS CONTROL POINT CONTROL SYSTEM.

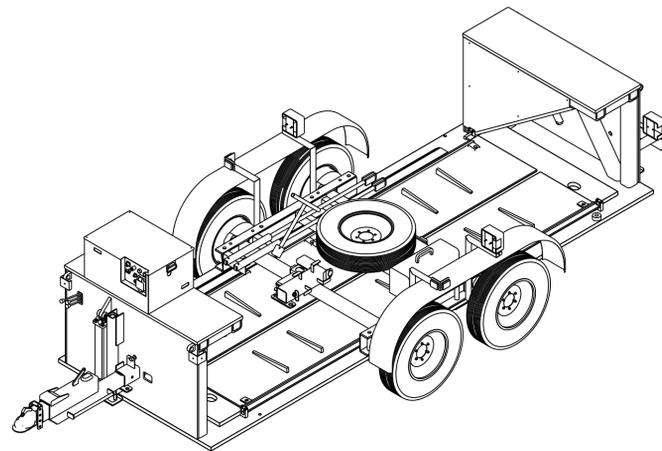
AMERICAN SOCIETY OF TESTING MATERIALS (ASTM) F2656-07 STANDARD TEST METHOD
 FOR VEHICLE CRASH TESTING OF PERIMETER BARRIERS.

ACTIVE VEHICLE BARRIERS:

CAUTION: THE FORCE OF IMPACT CONDITIONS BASED ON A RANGE OF ANY VEHICLE RAMMING
 THESE BARRIERS AT SPEEDS ABOVE 20 MPH MAY BE LETHAL TO THE OCCUPANTS OF
 THAT VEHICLE. CERTAIN CIRCUMSTANCES MAY RESULT IN FATALITIES AT SPEEDS
 SIGNIFICANTLY LOWER THAN 20 MPH. THEREFORE, EXTREME CAUTION MUST BE EXERCISED
 TO ENSURE THAT THEY ARE NOT ACTIVATED AT THE WRONG TIME.

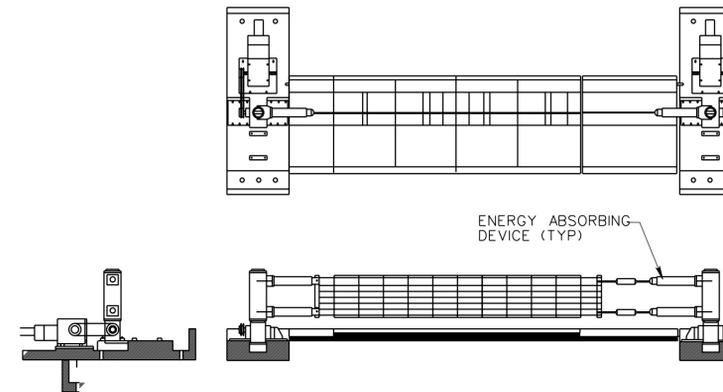


BARRIER RATING: K8, K12
 OPERATION: ENERGY OF RAMMING VEHICLE IS ABSORBED
 BY A NET OR CABLE SYSTEM.
 COMMENT: BRINGS VEHICLE TO A STOP IN A SHORT
 DISTANCE.



PORTABLE ACTIVE VEHICLE BARRIERS

NOT TO SCALE



ENERGY ABSORBING
 DEVICE (TYP)

NET BARRIERS

NOT TO SCALE



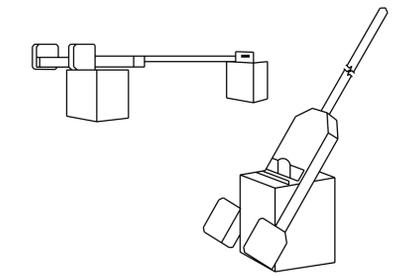
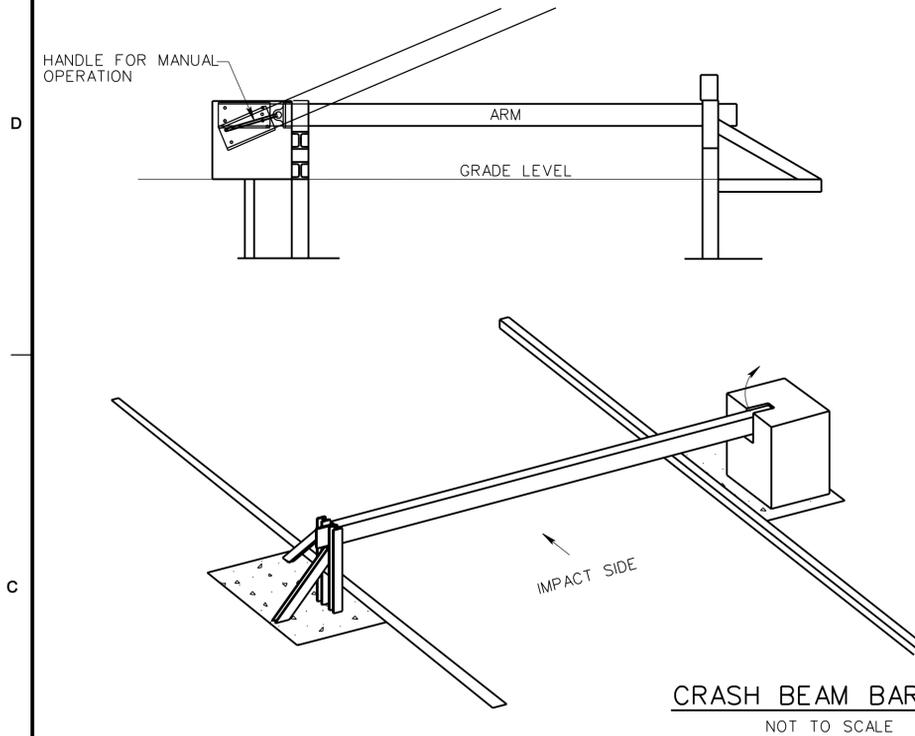
SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007	SOLICITATION NO.: W15FH07XG004	CONTRACT NO.:	PILOT DATE:
DWN BY: X.X.X.	CHK BY: X.X.X.	FILE NAME: X	CATEGORY CODE: X	PILOT SCALE: 1:1
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT				

FACILITIES STANDARDIZATION PROGRAM
 ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
BARRIERS
 ACTIVE VEHICLE BARRIERS

SHEET
 REFERENCE
 NUMBER
C9.04
 SHEET 26 OF 60

\$\$\$CONSREFC04
 \$\$\$SYSTEMS
 \$\$\$USERNAME\$\$

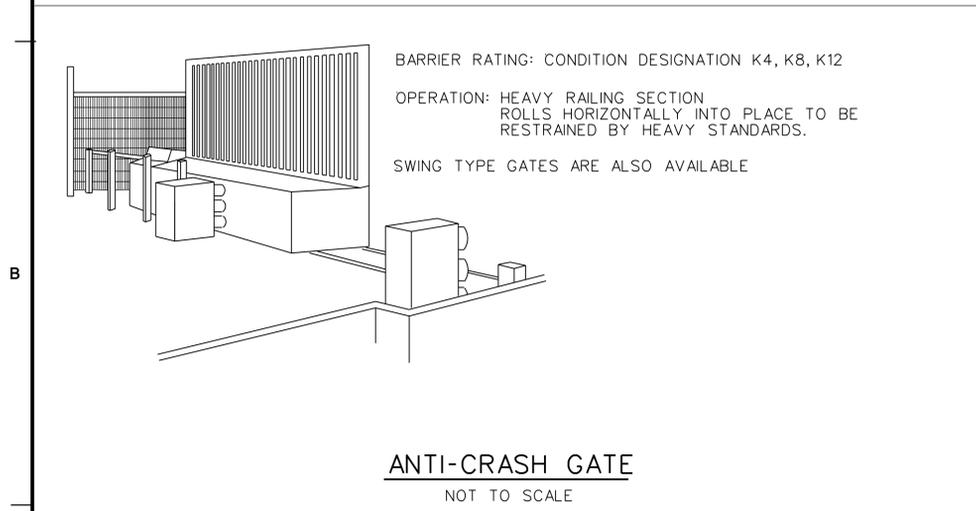


BARRIER RATING: K4, K8, K12
 OPERATION: MANUAL RAISING AND LOWERING
 (OPTION FOR HYDRAULIC OR ELECTRICAL OPERATION)

Notes:

1. **IMPACT KINETIC ENERGY**
 Impact kinetic energy in Ft-Lbs = $KE = 1/2 * Mass * (Velocity)^2$
 Where Mass = Weight (Lbs)/32.2 feet/(second)²
 Velocity = Speed (feet/second) * Sin(θ)
 θ = Impact Angle in degrees between the vehicle and barrier
 For the vehicle weight (W) given in Lbs and the vehicle speed (S) given in miles per hour, the kinetic energy in Ft-Lbs is:
 $KE = 0.03344 * W * (S * Sin(\theta))^2$
 For active barriers deployed in the roadway at the end of the ACP corridor, the vehicle impact angle is 90°. For passive barriers along the perimeter of the ACP corridor, the maximum impact angle must be determined by evaluating the vehicle's speed, the roadway alignment, and the clear roadway width. Maximum vehicle impact angles and speeds will vary along ACP corridors with speed management features such as curves and turns. Passive barrier systems must be capable of stopping the threat vehicle anywhere along the ACP corridor. See Draft UFC 4-022-02 "Selection and Application of Vehicle Barriers" and Appendix D for information on determining impact angles.

2. Examples of both active and passive barriers are shown on these drawings. Some of the examples show actual barriers supplied by barrier manufacturers. For additional information on any barrier shown or other barriers not shown, contact the Protective Design Center at the USACE, Omaha District.



BARRIER RATING: CONDITION DESIGNATION K4, K8, K12
 OPERATION: HEAVY RAILING SECTION
 ROLLS HORIZONTALLY INTO PLACE TO BE
 RESTRAINED BY HEAVY STANDARDS.
 SWING TYPE GATES ARE ALSO AVAILABLE

BARRIER SELECTION

THESE STANDARD DRAWINGS SHOW ACTIVE AND PASSIVE BARRIERS. THE SELECTION OF BARRIER TYPE IS LEFT TO LOCAL SECURITY PLANNERS. BASE SELECTION ON THE DEFINED THREAT, THE TERRAIN ENCOUNTERED, THE SPEED OF DEPLOYMENT, AND THE INITIAL COST OF THE BARRIERS. ALSO CONSIDER FACTORS SUCH AS ANNUAL MAINTENANCE COST, REPLACEMENT OR REPAIR COST SHOULD THE BARRIER EVER BE USED, AND THE SAFETY OF INNOCENT PERSONS WHO COULD POTENTIALLY BE CAUGHT IN THE BARRIER WHEN IT IS DEPLOYED.

STATE DEPARTMENT RATING

- K4 = 15,000 POUND VEHICLE TRAVELING AT 48 KPH (30 MPH)
- K8 = 15,000 POUND VEHICLE TRAVELING AT 64 KPH (40MPH)
- K12 = 15,000 POUND VEHICLE TRAVELING AT 80 KPH (50 MPH)

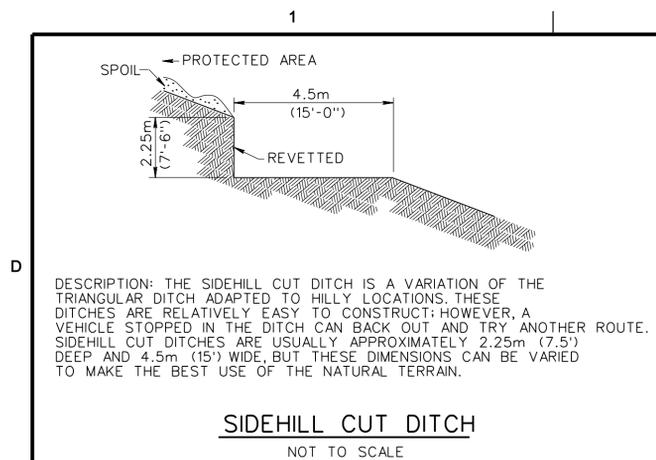


SYMBOL	DESCRIPTION	DATE	BY

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DWN BY: X.X.X	CHK BY: X.X.X	SUBMITTED BY: X	FILE NAME: X	SIZE: ANSI D	PILOT SCALE: 1:1
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT					

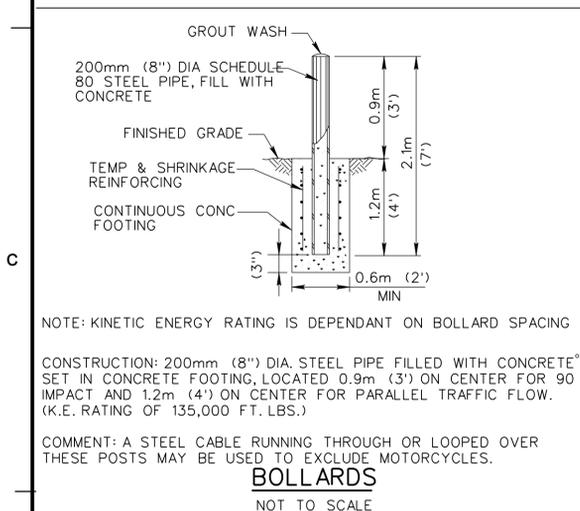
FACILITIES STANDARDIZATION PROGRAM
 ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
BARRIERS
 ACTIVE VEHICLE BARRIERS

SHEET
 REFERENCE
 NUMBER
C9.05
 SHEET 27 OF 60



DESCRIPTION: THE SIDEHILL CUT DITCH IS A VARIATION OF THE TRIANGULAR DITCH ADAPTED TO HILLY LOCATIONS. THESE DITCHES ARE RELATIVELY EASY TO CONSTRUCT; HOWEVER, A VEHICLE STOPPED IN THE DITCH CAN BACK OUT AND TRY ANOTHER ROUTE. SIDEHILL CUT DITCHES ARE USUALLY APPROXIMATELY 2.25m (7.5') DEEP AND 4.5m (15') WIDE, BUT THESE DIMENSIONS CAN BE VARIED TO MAKE THE BEST USE OF THE NATURAL TERRAIN.

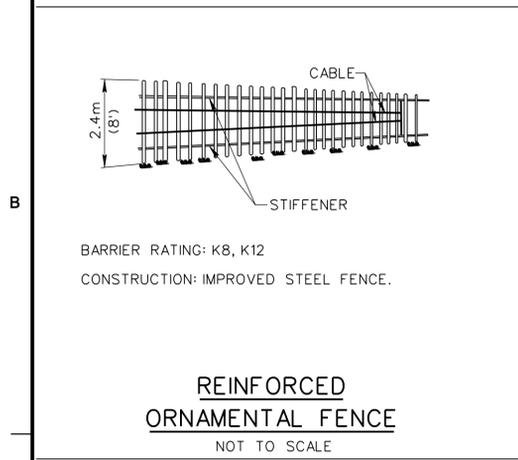
SIDEHILL CUT DITCH
NOT TO SCALE



NOTE: KINETIC ENERGY RATING IS DEPENDANT ON BOLLARD SPACING
CONSTRUCTION: 200mm (8") DIA. STEEL PIPE FILLED WITH CONCRETE SET IN CONCRETE FOOTING, LOCATED 0.9m (3') ON CENTER FOR 90 IMPACT AND 1.2m (4') ON CENTER FOR PARALLEL TRAFFIC FLOW. (K.E. RATING OF 135,000 FT. LBS.)

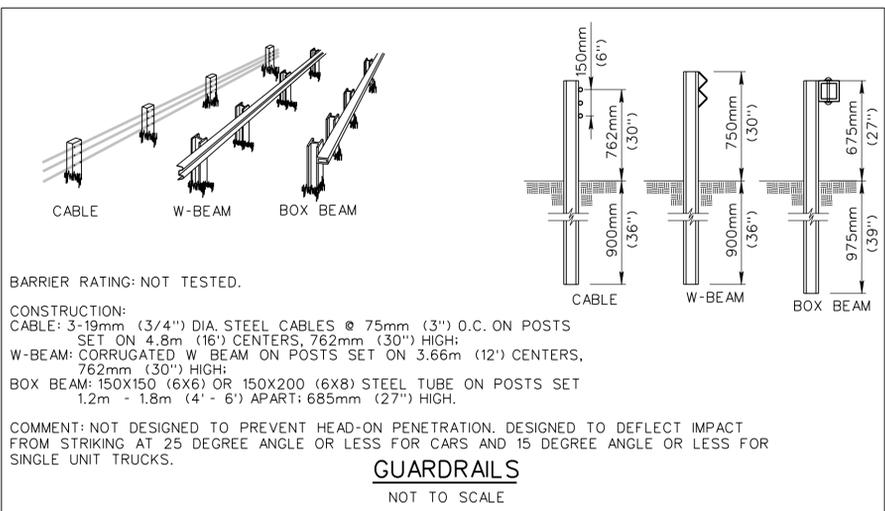
COMMENT: A STEEL CABLE RUNNING THROUGH OR LOOPED OVER THESE POSTS MAY BE USED TO EXCLUDE MOTORCYCLES.

BOLLARDS
NOT TO SCALE



BARRIER RATING: K8, K12
CONSTRUCTION: IMPROVED STEEL FENCE.

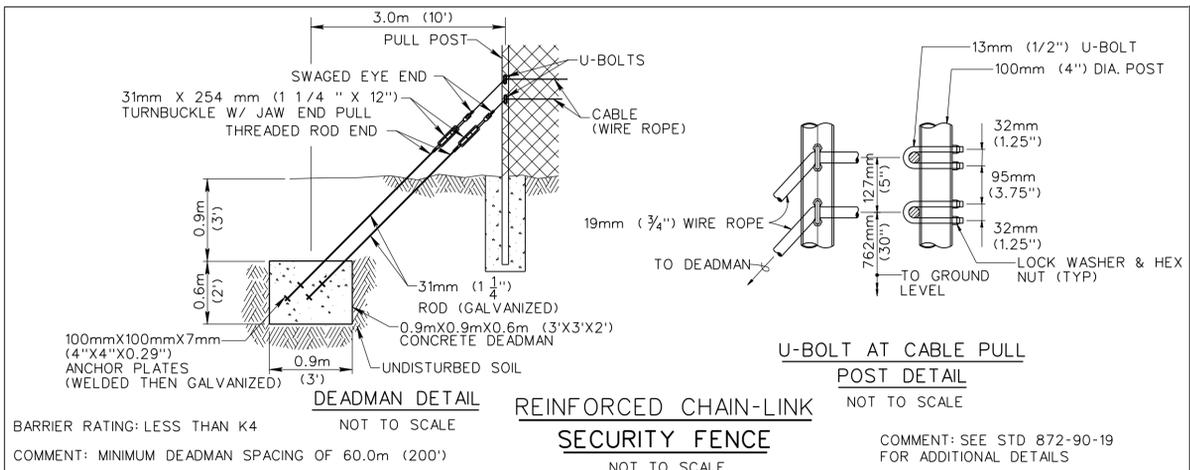
REINFORCED ORNAMENTAL FENCE
NOT TO SCALE



BARRIER RATING: NOT TESTED.
CONSTRUCTION:
CABLE: 3-19mm (3/4") DIA. STEEL CABLES @ 75mm (3") O.C. ON POSTS SET ON 4.8m (16') CENTERS, 762mm (30") HIGH;
W-BEAM: CORRUGATED W BEAM ON POSTS SET ON 3.66m (12') CENTERS, 762mm (30") HIGH;
BOX BEAM: 150X150 (6X6) OR 150X200 (6X8) STEEL TUBE ON POSTS SET 1.2m - 1.8m (4' - 6') APART; 685mm (27") HIGH.

COMMENT: NOT DESIGNED TO PREVENT HEAD-ON PENETRATION. DESIGNED TO DEFLECT IMPACT FROM STRIKING AT 25 DEGREE ANGLE OR LESS FOR CARS AND 15 DEGREE ANGLE OR LESS FOR SINGLE UNIT TRUCKS.

GUARDRAILS
NOT TO SCALE



BARRIER RATING: LESS THAN K4
COMMENT: MINIMUM DEADMAN SPACING OF 60.0m (200')

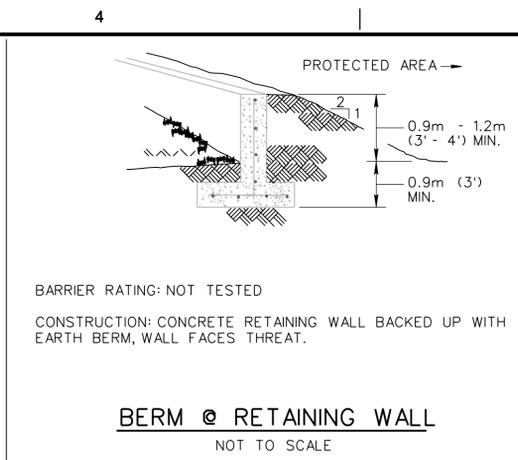
REINFORCED CHAIN-LINK SECURITY FENCE
NOT TO SCALE

PASSIVE BARRIERS

VEHICLE BARRIER
A BARRIER IS PASSIVE IF ITS EFFECTIVENESS RELIES ON ITS BULK, MASS, OR POSITION. PASSIVE BARRIERS HAVE NO MOVING PARTS. A BARRIER IS ACTIVE IF IT REQUIRES ACTION BY PERSONNEL OR EQUIPMENT TO PERMIT OR DENY ENTRY. ACTIVE BARRIERS ARE THOSE DEVICES USED TO CONTROL ACCESS THROUGH AN ACP OR ENTRANCE. PASSIVE BARRIERS ARE USED TO CHANNEL THE FLOW OF TRAFFIC TO PREVENT VEHICLES FROM BYPASSING ACCESS POINTS.

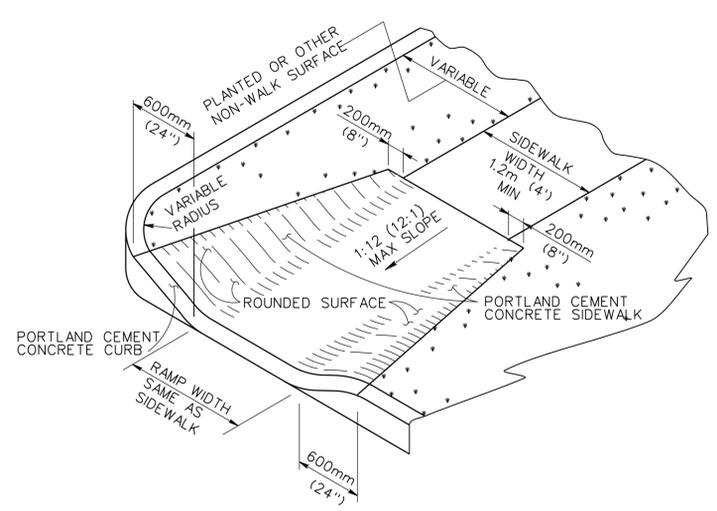
SELECTION OF PASSIVE BARRIERS
THE SELECTION OF A SPECIFIC BARRIER IS LEFT TO THE LOCAL SECURITY PLANNERS. SELECT BARRIERS BASED ON THE THREAT IDENTIFIED, THE TERRAIN ENCOUNTERED, THE VISUAL APPEARANCE DESIRED, AND THE BUDGET FOR THE BARRIERS. ALSO CONSIDER MAINTENANCE COSTS INCLUDING REMOVAL OF PLANT GROWTH, TRASH AND SNOW REMOVAL; REPAIR OR REPLACEMENT COSTS IF THE BARRIER IS BREACHED; EASE OF RELOCATING THE BARRIER; AND THE HAZARD PRESENTED TO INNOCENT PERSONNEL WHO MAY ACCIDENTALLY STRIKE THE BARRIER.

- NOTES**
1. APPEARANCE IS OFTEN A MAJOR CONSIDERATION WHEN SELECTING PASSIVE BARRIERS. THE INSTALLATION OF VEHICLE BARRIERS AROUND A SITE WILL NOT PREVENT PENETRATION OF THE SITE BY UNAUTHORIZED PERSONNEL. GIVEN TIME, ANY OF THESE BARRIERS MAY BE PENETRATED. THE BARRIERS DO PREVENT EASY MOBILE ACCESS FROM BOTH OUTSIDE AND INSIDE, DO DELAY BREACHING, AND DO DEMONSTRATE AN ADVERSARY'S INTENT. PLACING BARRIERS NEAR THE OUTSIDE PERIMETER FORCES THE ADVERSARY TO HAND CARRY HIS WEAPON TO HIS TARGET.
 2. MOST PASSIVE BARRIERS WILL NOT EXCLUDE PERSONNEL ON FOOT OR ON MOTORCYCLES. THESE BARRIERS SHOULD BE SUPPLEMENTED TO EXCLUDE MOTORCYCLES AND PEDESTRIANS IF THEY ARE IDENTIFIED AS THREATS.
 3. IN ADDITION TO THE PROBLEMS OF PLANT GROWTH, WINDBLOWN TRASH, AND SNOW, DETECTION SENSOR LOCATIONS AND VIDEO ASSESSMENT POSITIONS MUST BE CONSIDERED WHEN ADDING PASSIVE BARRIERS TO A SITE. ALSO PASSIVE BARRIERS MAY BE USED BY AN ADVERSARY FOR FIRING POSITIONS OR CONCEALMENT. GROWTH CHARACTERISTICS OF PLANTS USED IN PLANTERS MUST BE CONSIDERED TO AVOID OBSTRUCTING THE GUARD'S VIEWS OF ONCOMING TRAFFIC.



BARRIER RATING: NOT TESTED
CONSTRUCTION: CONCRETE RETAINING WALL BACKED UP WITH EARTH BERM, WALL FACES THREAT.

BERM @ RETAINING WALL
NOT TO SCALE



CURB RAMP DETAIL
NOT TO SCALE

- REFERENCE MATERIAL**
1. DEPT. OF STATE, D.O.S., SD-SDT-02-01: SPECIFICATION FOR VEHICLE CRASH TESTING OF PERIMETER BARRIERS AND GATES
 2. UFC 4-020-01 SECURITY ENGINEERING: PLANNING MANUAL
 3. UFC 4-020-02 SECURITY ENGINEERING: DESIGN MANUAL
 4. UFC 4-022-01 ENTRY CONTROL FACILITIES/ACCESS CONTROL POINTS

RELATED DRAWINGS
STD 872-90-01 STANDARD DETAILS FOR CHAIN-LINK SECURITY FENCES, FARM STYLE FENCES AND A DOUBLE CABLE BARRIER

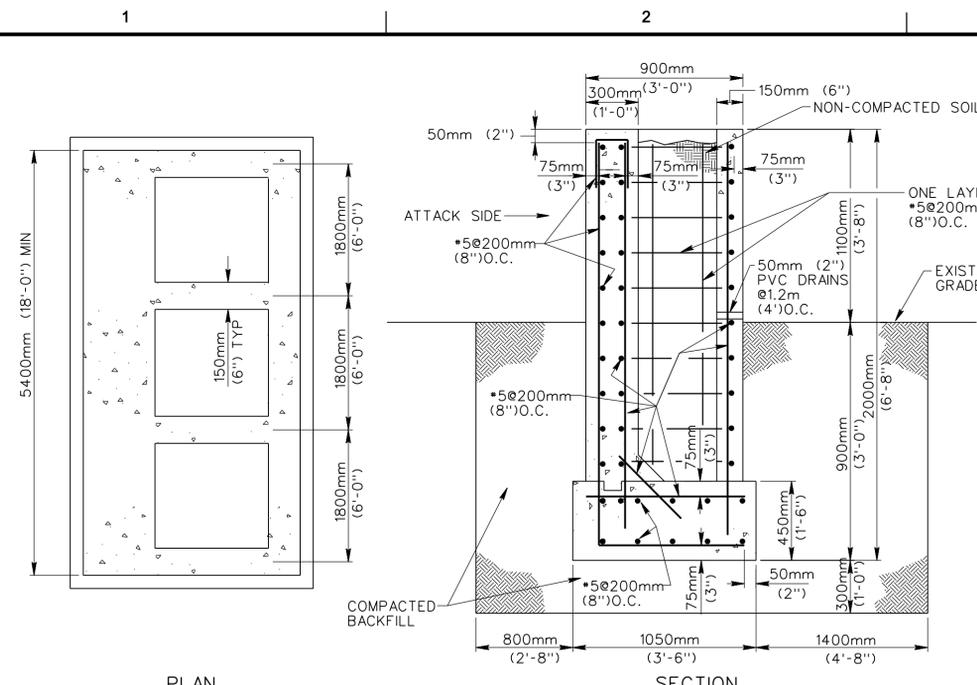


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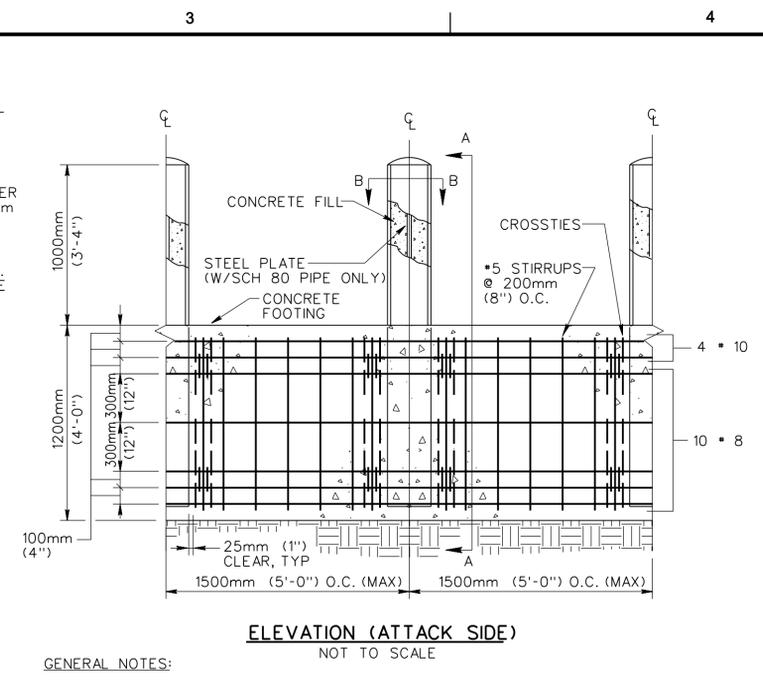
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SUBMITTED BY: X					
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SIZE: ANSI D					
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FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
BARRIERS
PASSIVE VEHICLE BARRIERS

SHEET REFERENCE NUMBER
C9.06
SHEET 28 OF 60

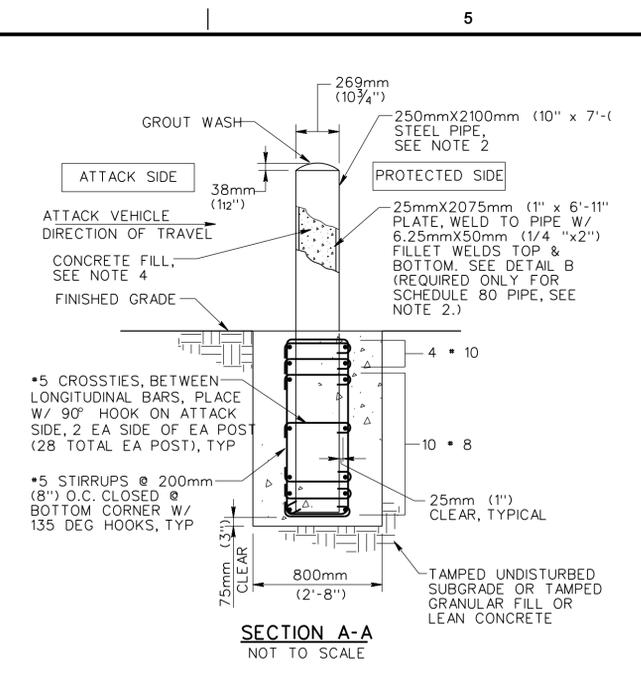


PLAN
SECTION
DS-9 PLANTER; K12 RATING
NOT TO SCALE

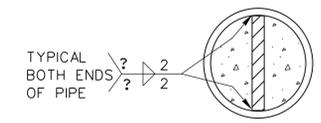


ELEVATION (ATTACK SIDE)
NOT TO SCALE

- GENERAL NOTES:**
1. REINFORCING SHALL BE ASTM A-615, Fy = 60 KSI.
 2. STEEL PIPE SHALL BE ASTM A-53 GRADE B, Fy = 36 KSI
OPTION 1: SCHEDULE 140 (25mm (1") WALL THICKNESS)
OPTION 2: SCHEDULE 80 (12mm (1/2") WALL THICKNESS WITH 25mmX2075mm (1"x83") PLATE (SEE DETAILS).
 3. STEEL PLATE SHALL BE ASTM A-36, Fy = 36 KSI.
 4. CONCRETE MINIMUM F'c = 24,130 kPa (3500 PSI) IN ACCORDANCE WITH ASTM C31, C39 AND C470.
 5. SOILS SHALL BE COMPACTED TO 90% MAXIMUM DENSITY.
 6. STAGGERED CLASS A TENSION SPLICES SHALL BE ALLOWED FOR HORIZONTAL REINFORCING.
 7. CROSSSTIES SHALL HAVE STANDARD 90 AND 180 BENDS AND SHALL BE PLACED WITH 90 BEND TOWARD THE ATTACK SIDE OF THE FOOTING. PROVIDE 7 PAIRS OF CROSSSTIES COMBINED WITH FIRST STIRRUP EACH SIDE OF EACH BOLLARD (SEE ELEVATION).
 8. ALL EXPOSED CORNERS SHALL HAVE A 3/4" CHAMFER.



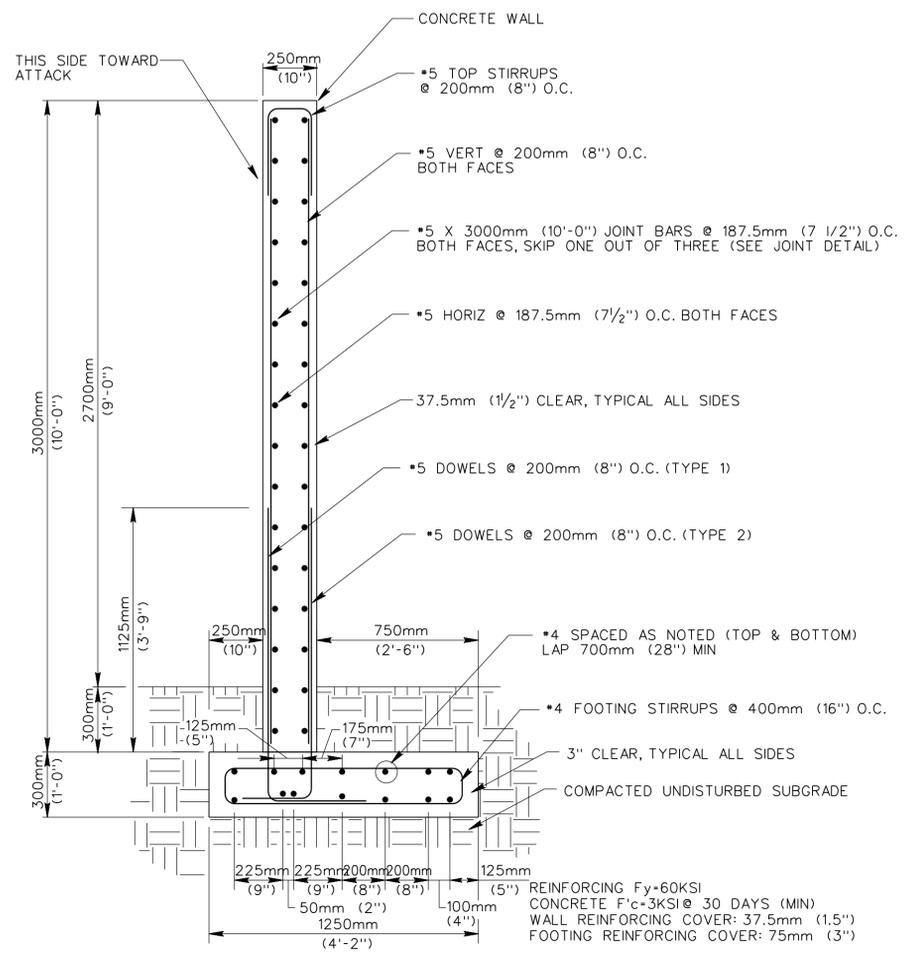
SECTION A-A
NOT TO SCALE



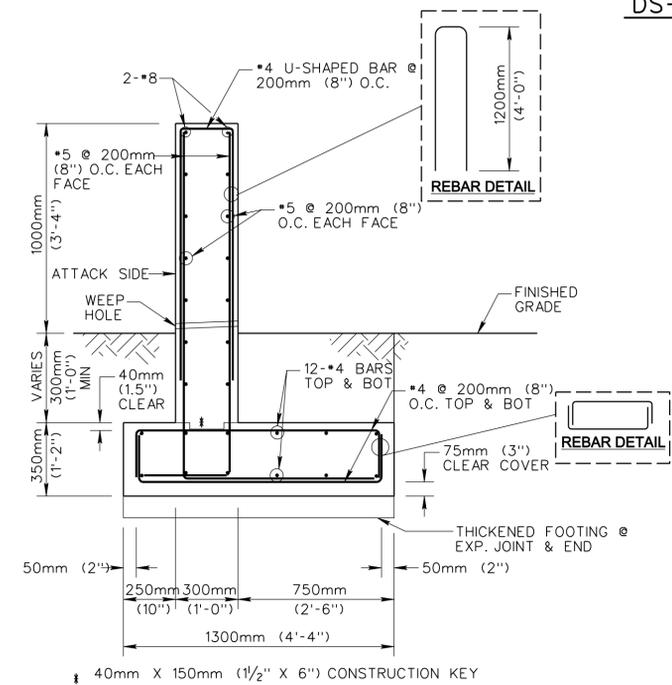
TYPICAL BOTH ENDS OF PIPE

WELD STEEL PLATE WITHIN STEEL PIPE PARALLEL TO VEHICLE TRAVEL DIRECTION. PLATE REQUIRED ONLY FOR SCHEDULE 80 PIPE. (SEE NOTE 2, OPTION 2)

SECTION B-B
NOT TO SCALE

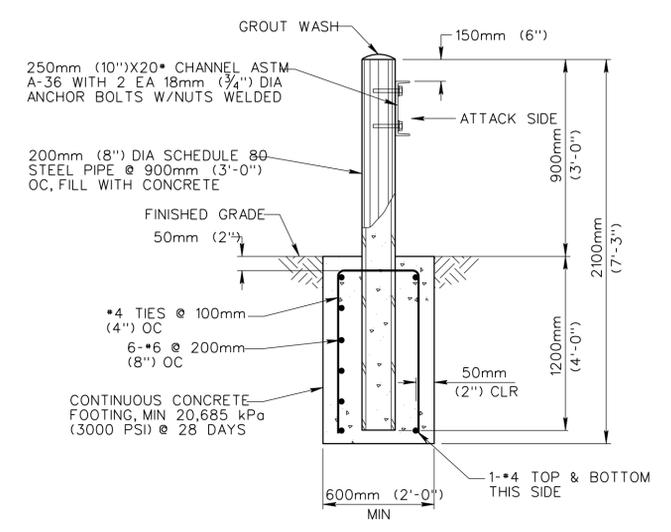


ANTI-RAM WALL; K12 RATING
NOT TO SCALE



DS-50 1 METER ANTI-RAM KNEE WALL, K12 RATING
NOT TO SCALE

DS-22 BOLLARD; K12 RATING
NOT TO SCALE

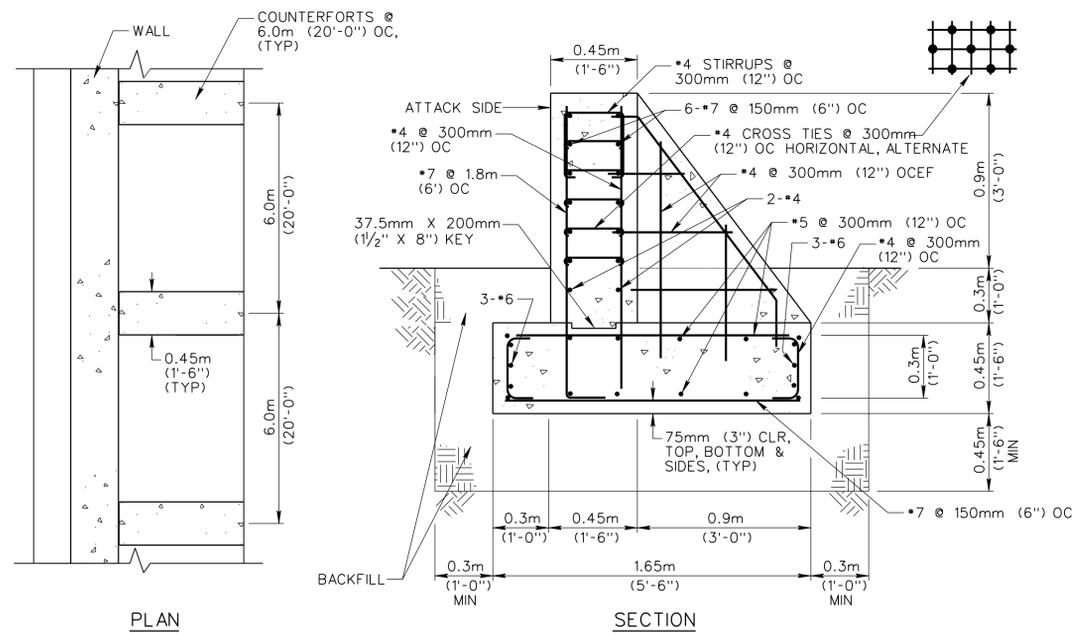


DS-3 BOLLARD W/C CHANNEL RAIL; K12 RATING
NOT TO SCALE

<p>US ARMY CORPS OF ENGINEERS OMAHA DISTRICT</p>	
DESIGNED BY:	DATE:
DWN BY:	SOLICITATION NO.:
SUBMITTED BY:	CONTRACT NO.:
FILE NAME:	CATEGORY CODE:
SIZE:	PLOT DATE:
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<p>FACILITIES STANDARDIZATION PROGRAM ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS</p>	
<p>BARRIERS PASSIVE VEHICLE BARRIERS</p>	
<p>SHEET REFERENCE NUMBER C9.07 SHEET 29 OF 60</p>	

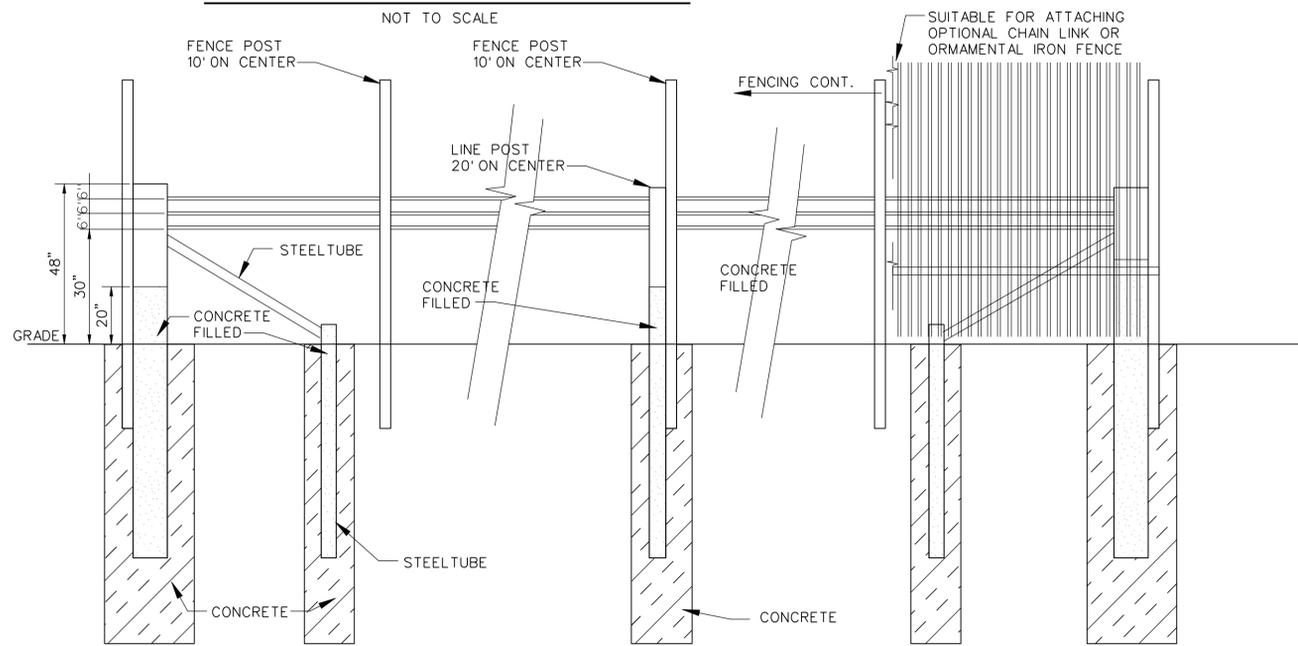
48CONSP024
48SYSTEMS
48USERNAME55

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.

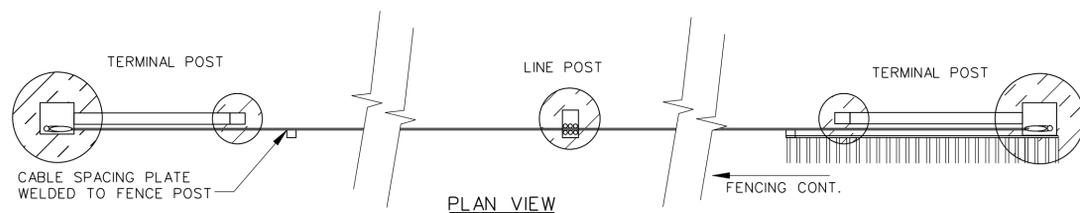


DS-6 COUNTERFORT WALL; K8 RATING

NOT TO SCALE



ELEVATION VIEW



PLAN VIEW

CABLE BARRIER: K12, P1 RATING

ALSO AVAILABLE IN K4 AND K8 CONFIGURATIONS WITH P2 PENETRATION RATINGS PER ASTM F2656-07

NOTES:

1. FOR ADDITIONAL INFORMATION ON ANY BARRIER SHOWN ON THESE DRAWINGS, CONTACT THE PROTECTIVE DESIGN CENTER (PDC).



SYMBOL	DESCRIPTION	DATE	BY

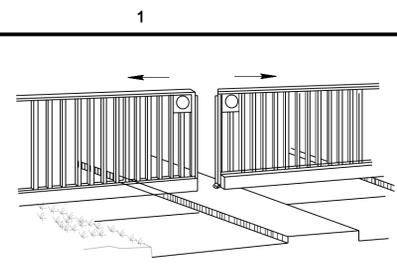
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U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT					

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
BARRIERS
PASSIVE VEHICLE BARRIERS

SHEET REFERENCE NUMBER
C9.08
SHEET 30 OF 60

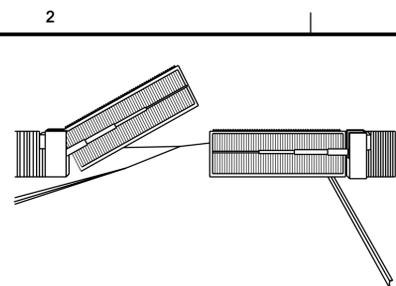
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\$\$\$SYSTEM\$\$\$
\$\$\$USERNAME\$\$\$

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.



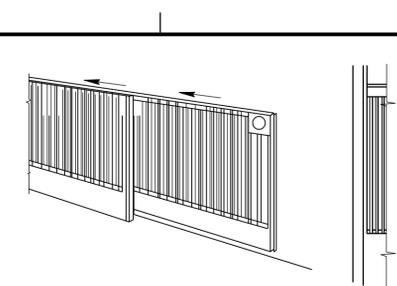
OPERATION: GATE SLIDES HORIZONTALLY, MANUALLY OR MOTOR OPERATED

SLIDING GATE
NOT TO SCALE



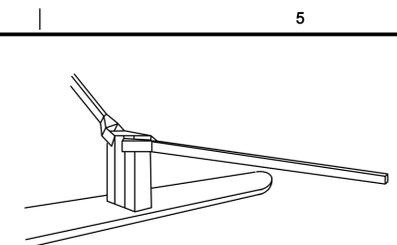
OPERATION: ARM AND GATE OPEN VERTICALLY, MOTORIZED.

VERTICAL PIVOT GATE
NOT TO SCALE



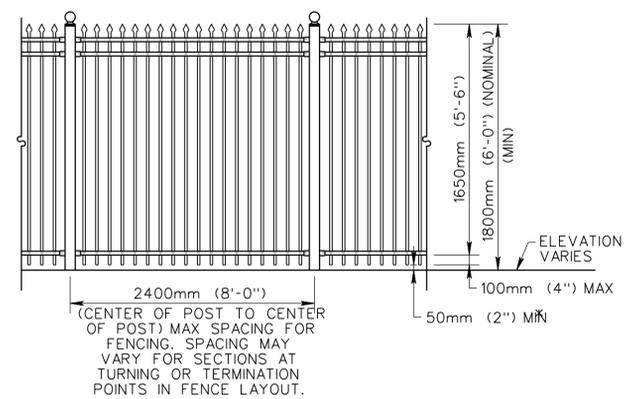
OPERATION: MULTIPLE SECTIONS MOVE HORIZONTALLY, MANUALLY OR MOTOR OPERATED.

TELESCOPING GATE
NOT TO SCALE



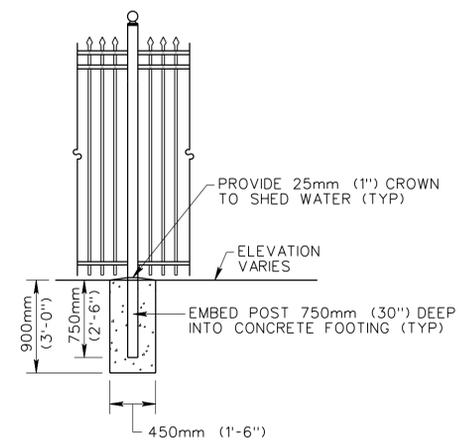
OPERATION: BEAMED RAISED TO ALLOW TRAFFIC TO PASS.

TRAFFIC ARM
NOT TO SCALE

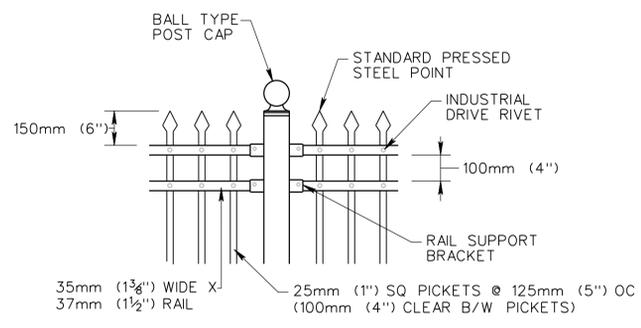


FENCING ELEVATION DETAIL
NOT TO SCALE

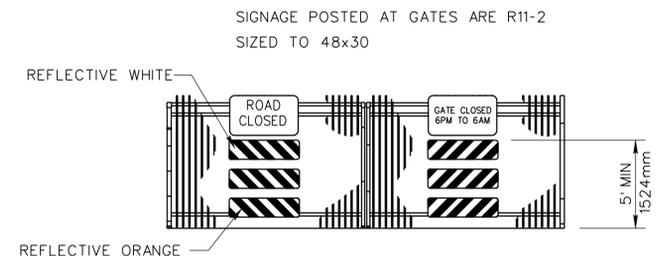
*CLEARANCE BETWEEN FENCE AND GROUND SHALL BE BETWEEN 50mm (2") MIN AND 100mm (4") MAX.



FENCE POST DETAIL
NOT TO SCALE



RAIL/POST DETAIL
NOT TO SCALE

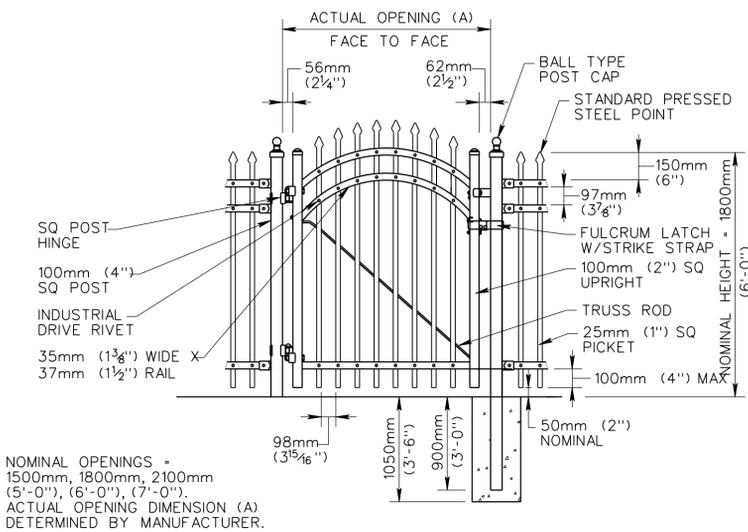


TYPE III BARRICADES

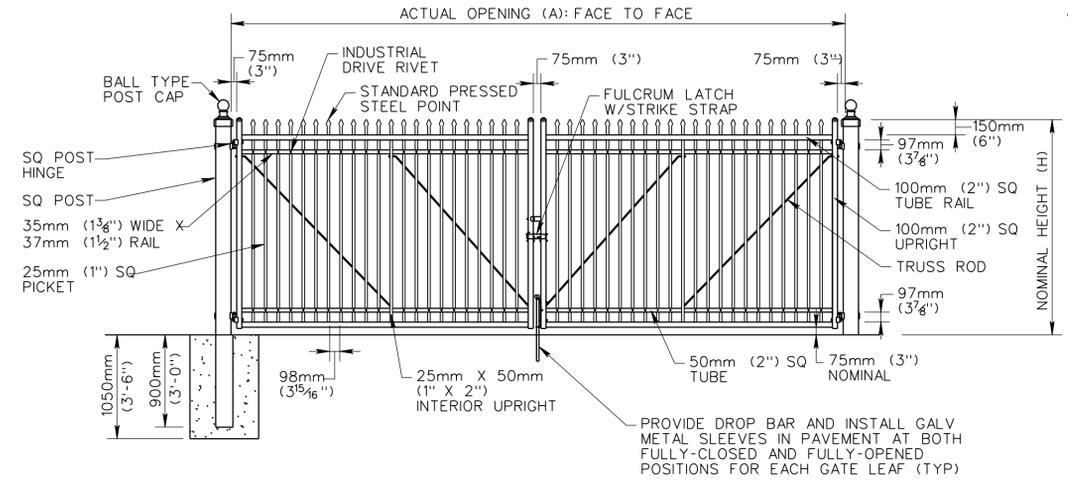
- TYPE III BARRICADES SHOULD BE USED DURING THE TIMES WHEN THE ACP IS CLOSED TO TRAFFIC
- A "GATE CLOSED" SIGN LISTING THE HOURS OF OPERATION SHOULD BE INSTALLED PRIOR TO THE BARRICADE, AND AT THE BARRICADE AS WELL.

FOR ACPs THAT HAVE FIXED HOURS AND ARE MORE THAN ONE MILE AWAY FROM THE PRIMARY ROADWAY, INSTALL SIGNS SHOWING THE HOURS OF ACP OPERATION IN ADVANCE OF THE ACP.

SIGNAGE DETAIL FOR ENTRY GATE
NOT TO SCALE



PERSONNEL SWING GATE DETAIL
NOT TO SCALE



ORNAMENTAL METAL FENCE DOUBLE SWING GATE ELEVATION DETAIL
NOT TO SCALE

NOTE: ITEMS SHOWN ON THIS PAGE ARE NOT VEHICLE IMPACT RESISTANT

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.

SYMBOL	DESCRIPTION	DATE	BY

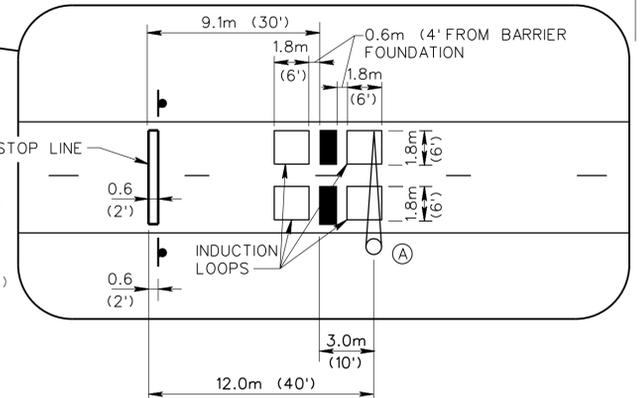
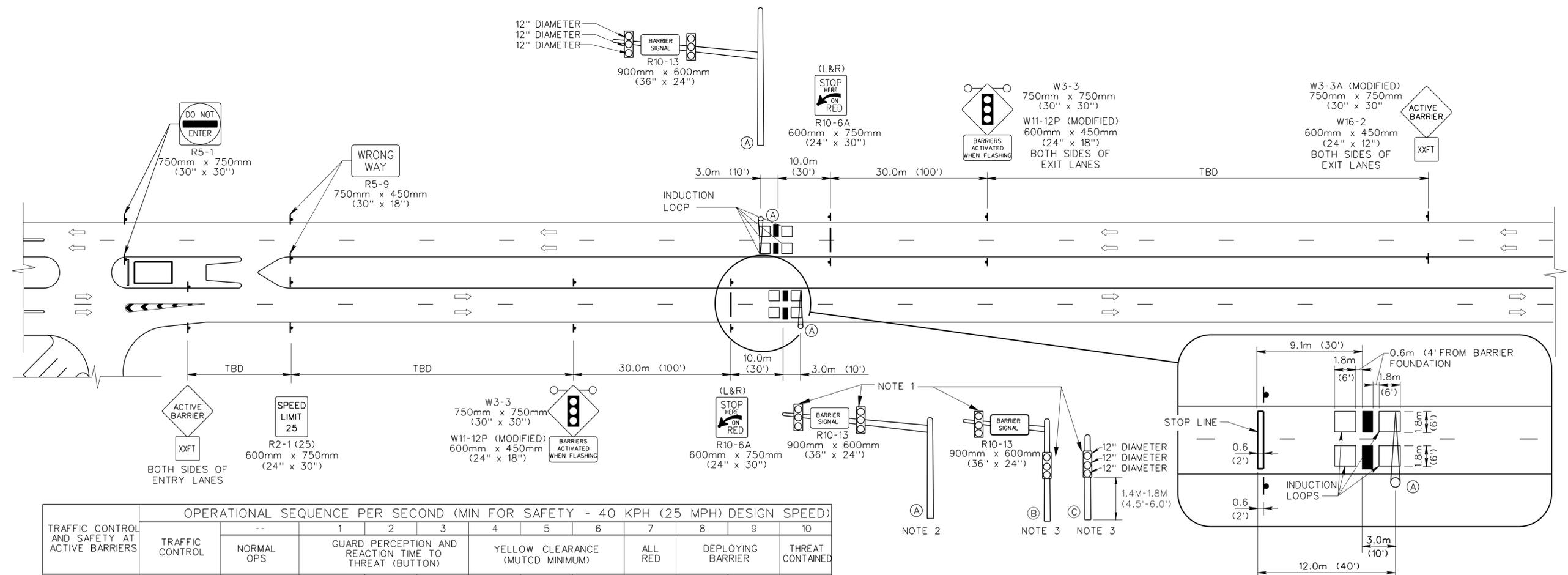
DESIGNED BY: X.X.X	DATE: NOV 2007	SOLICITATION NO.: W815R107X-6004	CONTRACT NO.:	PILOT DATE:
DWN BY: X.X.X				
SUBMITTED BY: X				
FILE NAME: X				
SIZE: ANS/D				
PILOT SCALE: 1:1				

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
GATES AND FENCES



D
C
B
A



		OPERATIONAL SEQUENCE PER SECOND (MIN FOR SAFETY - 40 KPH (25 MPH) DESIGN SPEED)										
TRAFFIC CONTROL AND SAFETY AT ACTIVE BARRIERS	TRAFFIC CONTROL	NORMAL OPS	GUARD PERCEPTION AND REACTION TIME TO THREAT (BUTTON)			YELLOW CLEARANCE (MUTCD MINIMUM)			ALL RED	DEPLOYING BARRIER		THREAT CONTAINED
	SIGN AND SIGNAL WARNING SYSTEM	WARNING SIGN WITH BEACONS	BLANK	BLANK	BLANK	BLANK	ALT FY	ALT FY	ALT FY	ALT FY	ALT FY	ALT FY
TRAFFIC SIGNAL		FY OR SOLID GREEN	FY OR G	FY OR G	FY OR G	Y	Y	Y	R	R	R	R
BARRIER LIGHTS		BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	FR	FR	FR	FR
ACTIVE BARRIER		DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	ACTIVATED	ACTIVATED	DEPLOYED

NOTE:
R = RED
Y = YELLOW
FY = FLASHING YELLOW
G = GREEN

- NOTES:
- ALL TRAFFIC SIGNAL FACES SHALL HAVE THE FOLLOWING SIGNAL INDICATIONS:
RED - 12" DIAMETER
YELLOW - 12" DIAMETER
FLASHING YELLOW OR GREEN - 8" DIAMETER
 - FOR MULTIPLE INBOUND OR MULTIPLE OUTBOUND LANES, USE DETAIL A WITH A SIGNAL FACE OVER EACH LANE.
 - FOR TWO LANE ROADWAYS WITH ONE INBOUND LANE AND ONE OUTBOUND LANE, THE PREFERRED TRAFFIC SIGNALIZATION IS ONE POST AND MAST STRUCTURE WITH SIGNAL FACES ON BOTH THE MAST AND THE POST (DETAIL B) FOR EACH LANE. AN ALTERNATIVE FOR ROADWAYS WITH ONE INBOUND AND ONE OUTBOUND LANE THAT ARE SEPARATED BY A MEDIAN ISLAND OF AT LEAST 5 FOOT WIDE, USE POST MOUNTED SIGNAL FACES (DETAIL C) WITH ONE POST MOUNTED ON THE RIGHT SHOULDER AND ANOTHER POST MOUNTED ON THE LEFT SHOULDER (MEDIAN ISLAND) FOR EACH LANE, THIS ALTERNATIVE REQUIRES A TOTAL OF 4 POSTS WITH SIGNAL FACES.
 - BARRIERS SHALL BE CONTROLLED BY A TRAFFIC CONTROLLER UNIT IN ACCORDANCE WITH UFGS 34 41 26.00 10 "ACCESS CONTROL POINT CONTROL SYSTEM" AND DRAWINGS E1.03 AND E1.04.

ACTIVE BARRIER SIGNS AND SIGNALS
NOT TO SCALE

- LEGEND
- TRAFFIC FLOW PATTERN
 - Y/100mm (4") PAINT STRIPE STYLE/WIDTH
 - DY DOUBLE YELLOW LINE
 - SW SOLID WHITE LINE
 - TRAFFIC ARM
 - ACTIVE VEHICLE BARRIER
 - ▬▬▬ PASSIVE VEHICLE BARRIER
 - xx— ORNAMENTAL FENCE
 - x— FENCE
 - BOLLARDS
 - CANOPY
 - ▭ BARRIER WALL
 - ▬▬▬ DOUBLE FACE GUARD RAIL
 - ▬▬▬ SINGLE FACE GUARD RAIL
 - ▭ GUARD BOOTH
 - ▭ GENERATOR PAD W/SIDEWALK
 - ▭ CURB RAMP
 - ⊙ TRAFFIC SIGNAL DETAILS

NO.	SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X	DATE: NOV 2007
DWN BY: X.X.X	SOLICITATION NO.: W815FHJ7X604
SUBMITTED BY: X.X.X	CONTRACT NO.:
FILE NAME: X.X.X	CATEGORY CODE: X
SIZE: ANSI D	PLOT SCALE: 1:1
	PLOT DATE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
ACTIVE BARRIER SIGNS AND SIGNALS

SHEET REFERENCE NUMBER
C9.10
SHEET 32 OF 60

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.

NOTES:

GENERAL

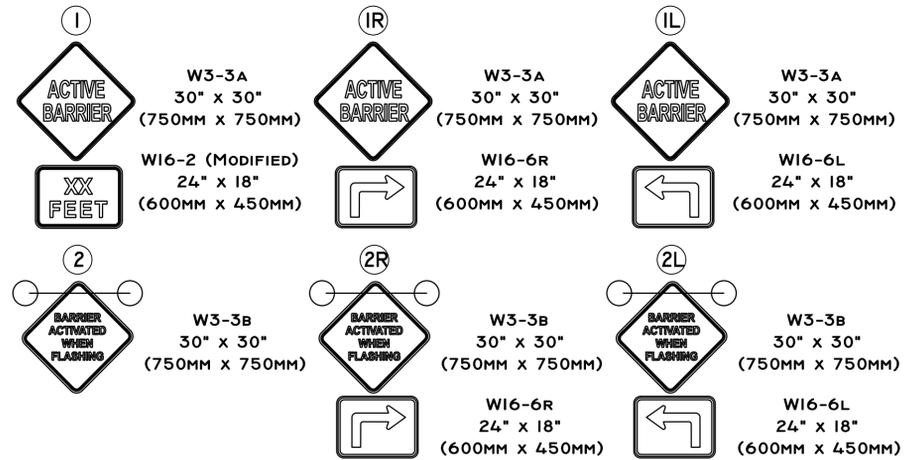
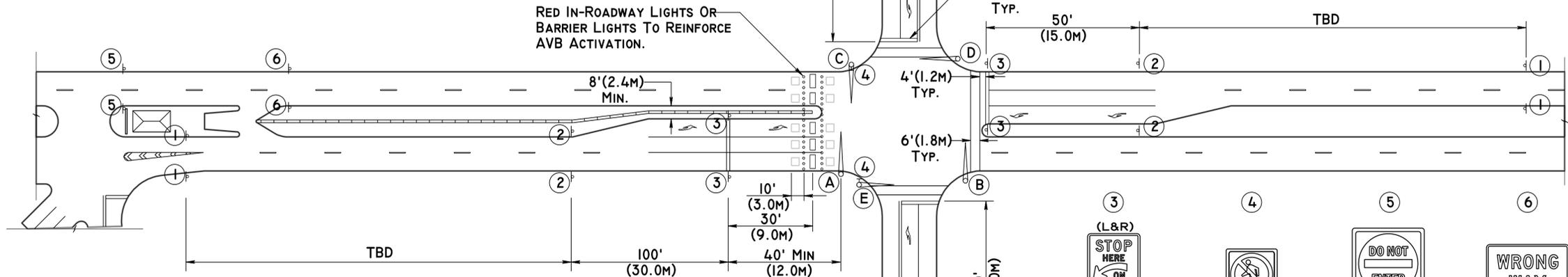
1. FINAL DESIGN AND OPERATIONAL ANALYSES IN ACCORDANCE WITH THE MUTCD AND TO BE PERFORMED BY A QUALIFIED TRAFFIC ENGINEER. PLANS FOR AVB SYSTEMS AT SIGNALIZED INTERSECTIONS SHALL BE REVIEWED BY SDDCTEA.
2. FINAL YELLOW AND RED CLEARANCE INTERVALS TO BE CALCULATED IN ACCORDANCE WITH THE MUTCD. FINAL YELLOW AND RED CLEARANCE INTERVALS MAY EXCEED THE FOUR SECONDS SHOWN.
3. PEDESTRIAN CROSSINGS ARE PERMITTED ON ALL APPROACHES EXCEPT THE APPROACH WITH THE AVBS ITSELF.
4. *NON-CONFLICTING MOVEMENTS CAN CONTINUE AS DIRECTED*

SIGNALS AND SIGNS

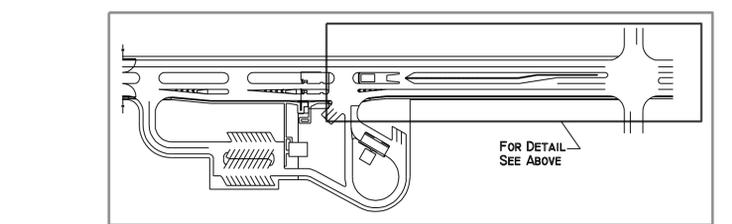
5. ALL SIGNALS AND SIGNS SHALL BE IN CONFORMANCE WITH THE MUTCD AND STATE DOT GUIDELINES.
6. SIGNAL AND SIGN INDICATIONS ON EACH POLE MAY VARY DEPENDING ON THE FINAL INTERSECTION DESIGN AND PHASING OPERATION.
7. FOR SINGLE LANE APPROACHES, SIGNS ARE NEEDED ON THE RIGHT SIDE ONLY.
8. USE OPTICALLY PROGRAMMED SIGNAL INDICATIONS FOR POLE B.

NORMAL MODE TO AVB PREEMPTION

9. *SIGNAL TO RUN 'NORMAL' PHASING PLAN WHEN AVB IS NOT ACTIVATED.*
10. *UPON AVB PREEMPTION, ALL 'NORMAL' PHASES WILL IMMEDIATELY CEASE THE GREEN PHASE AND TRANSITION TO OPERATIONAL SEQUENCE 4. FLASHING OPERATIONS WILL TRANSITION TO OPERATIONAL SEQUENCE 4.*
11. *ALL 'WALK' INDICATIONS WILL IMMEDIATELY TRANSITION TO 'FLASHING DONT WALK' (FDW). NORMAL FDW WILL BE PROVIDED AND MAY BE COMPLETED BEYOND OPERATIONAL SEQUENCE 10.*
12. ALL DEVICES TO REMAIN IN OPERATIONAL SEQUENCE 10 UNTIL THE SYSTEM IS RESET. NORMAL OPERATIONS TO RESET TO MAINLINE GREEN ONCE ALL AVBS HAVE BEEN FULLY RETRACTED.



TRAFFIC CONTROL AND SAFETY AT ACTIVE BARRIERS		OPERATIONAL SEQUENCE PER SECOND (MIN FOR SAFETY - 25 MPH (40 KPH) DESIGN SPEED)										
		TRAFFIC CONTROL	GUARD PERCEPTION AND REACTION TIME TO THREAT (BUTTON)				YELLOW CLEARANCE (MUTCD MINIMUM)			ALL RED	DEPLOYING BARRIER	
SIGN AND SIGNAL WARNING SYSTEM		NORMAL OPS	1	2	3	4	5	6	7	8	9	10
WARNING SIGN WITH BEACONS	BLANK	BLANK	BLANK	BLANK	BLANK	ALT FY	ALT FY	ALT FY	ALT FY	ALT FY	ALT FY	ALT FY
TRAFFIC SIGNAL	NORMAL SIGNAL OPERATIONS					Y	Y	Y	R	R	R	R
IN-ROADWAY LIGHTS OR BARRIER	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	FR	FR	FR	FR
ACTIVE BARRIER	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	ACTIVATED	ACTIVATED	DEPLOYED
NO LEFT TURN BLANKOUT POLE D	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	NLT	NLT	NLT	NLT
NO RIGHT TURN BLANKOUT POLE E	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	NRT	NRT	NRT	NRT



ACTIVE BARRIER SIGNS AND SIGNAL @ AN INTERSECTION
SHEET 1 OF 2
 NOT TO SCALE

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

DESIGNED BY: X.X.X.	DATE: NOV 2007
DRAWN BY: X.X.X.	SOLICITATION NO.: W15FHJ07X-6204
SUBMITTED BY: X.X.X.	CONTRACT NO.:
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANS/D	PLOT DATE:
PLOT SCALE: 1:1	

U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS

ACTIVE BARRIER SIGNS AND SIGNALS AT AN INTERSECTION SHEET 1 OF 2

SHEET REFERENCE NUMBER **C9.11**
 SHEET 33 OF 60

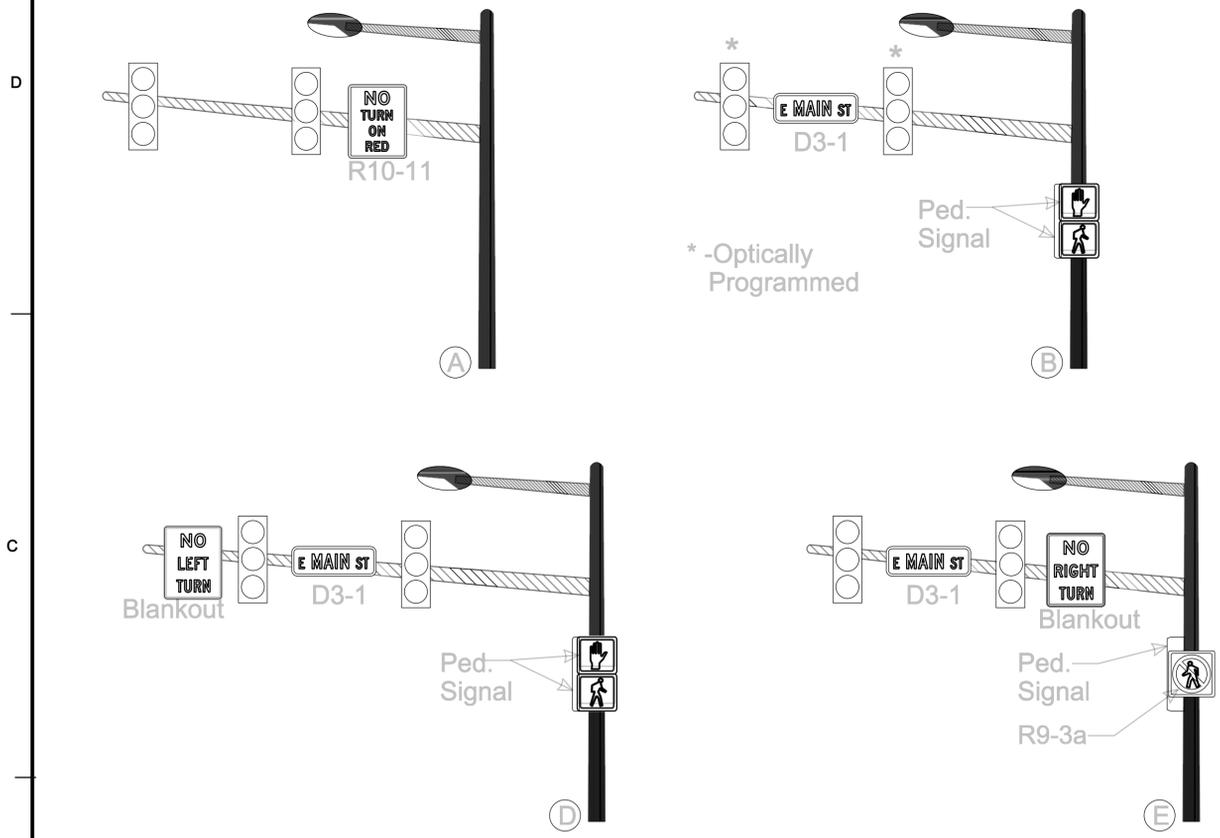
SECURITY CLASSIFICATION: UNCLASSIFIED
 SYSTEMS: UNCLASSIFIED
 USER NAME: \$

DESIGNED BY:	DATE:	SYMBOL:	DESCRIPTION:
DWN BY:	NOV 2007		
CHK BY:			
SUBMITTED BY:			
FILE NAME:			
SIZE:			
ANSI D:			
PLOT SCALE:			
PLOT DATE:			

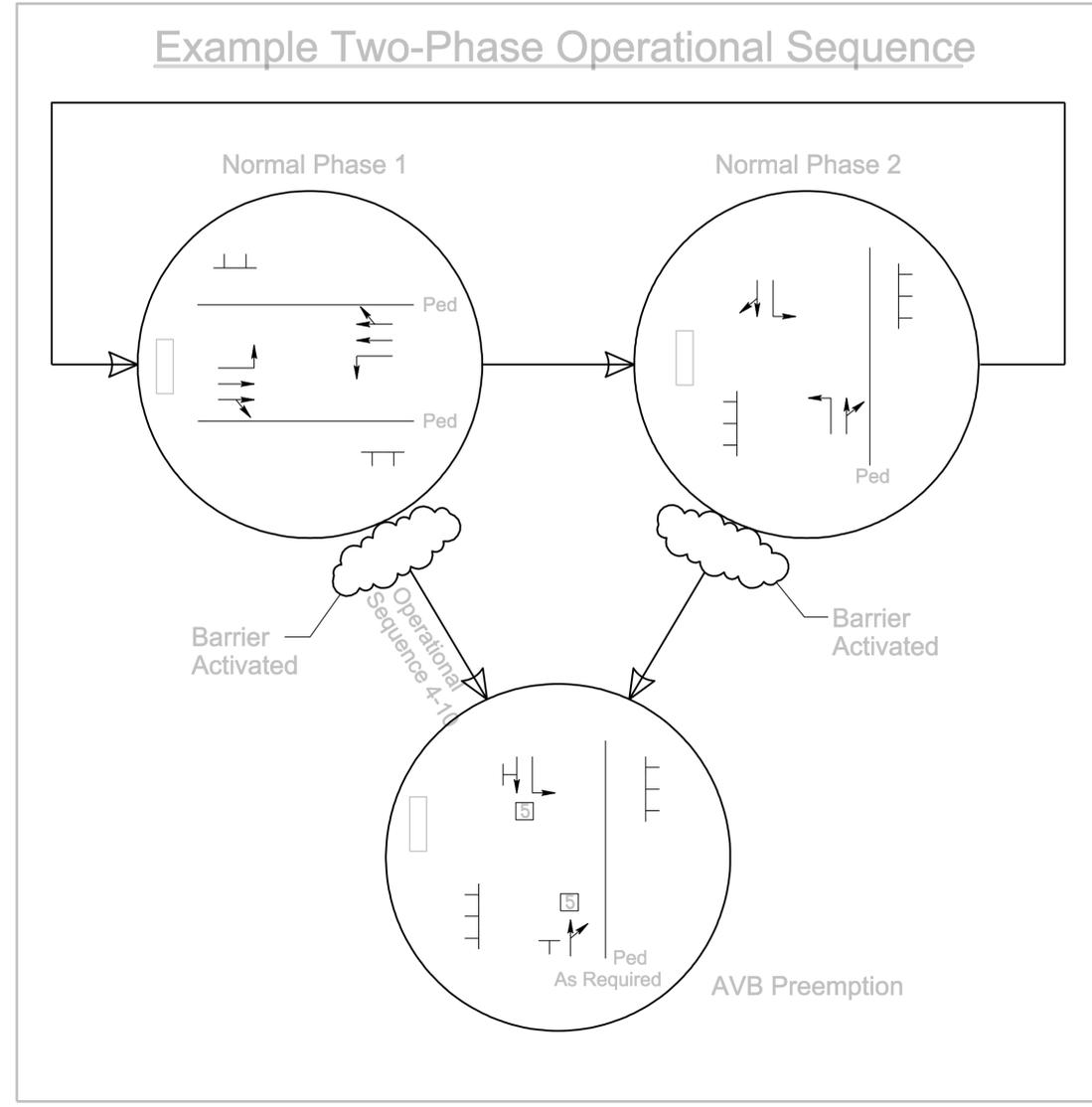
DESIGNED BY:	DATE:	SOLICITATION NO.:	CONTRACT NO.:
DWN BY:	NOV 2007	W15FH07X-6204	
CHK BY:			
SUBMITTED BY:			
FILE NAME:			
SIZE:			
ANSI D:			
PLOT SCALE:			
PLOT DATE:			

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
ACTIVE BARRIER SIGNS AND SIGNALS
AT AN INTERSECTION SHEET 2 OF 2

SHEET REFERENCE NUMBER
C9.12
SHEET 34 OF 60



Active Barrier Signs and Signal @ An Intersection
Sheet 2 of 2
Not To Scale



\$\$\$CONTRACT\$\$\$
\$\$\$SYSTEM\$\$\$
\$\$\$USERNAME\$\$\$

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.

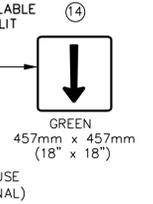
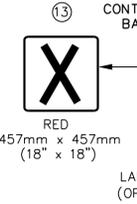
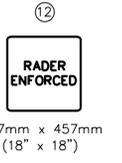
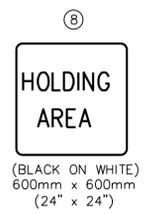
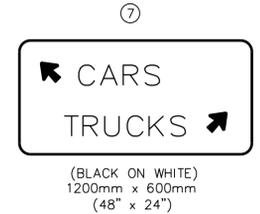
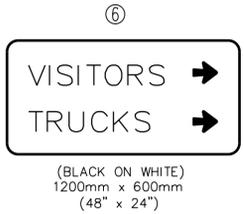
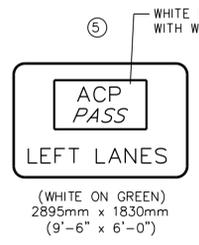
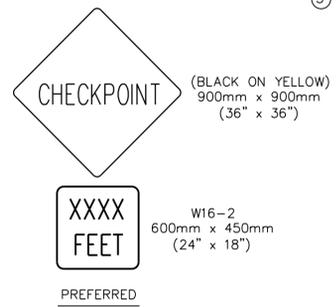
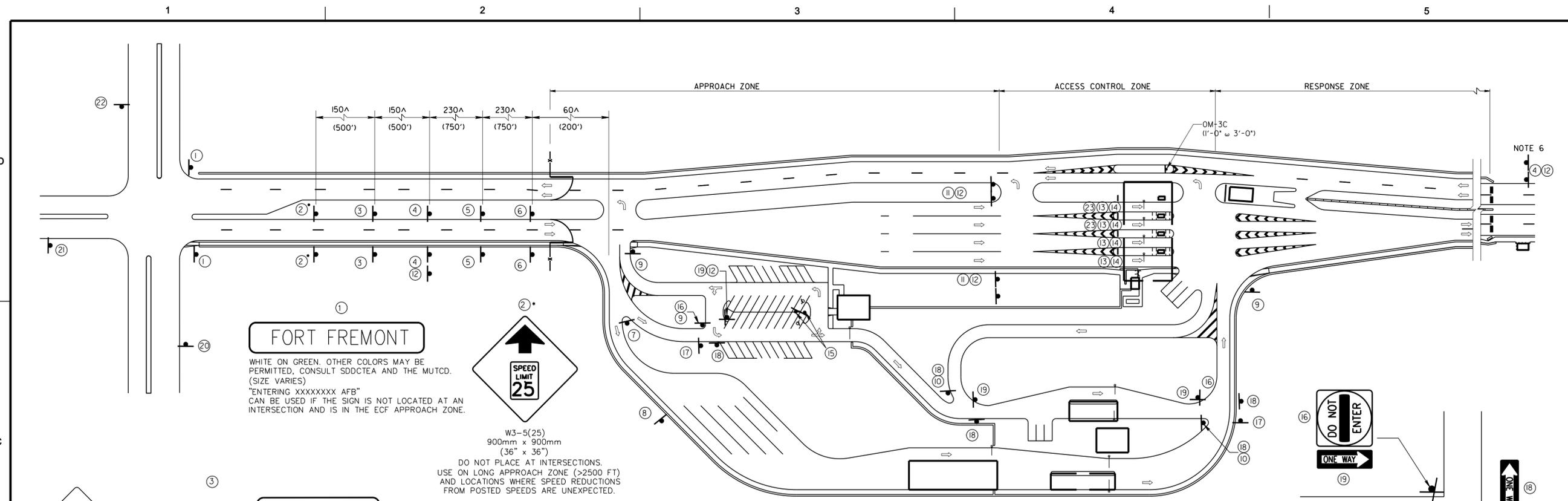
SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: XXX	CHK BY: XXX	DATE: NOV 2007
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FILE NAME:	FILE NAME:	FILE NAME:
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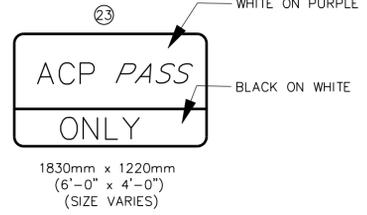
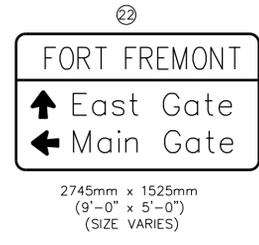
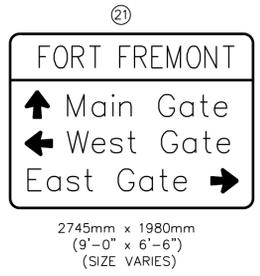
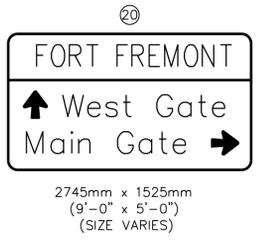
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
SITE PLAN
SIGN DETAILS AND TYPICAL SIGN LAYOUT

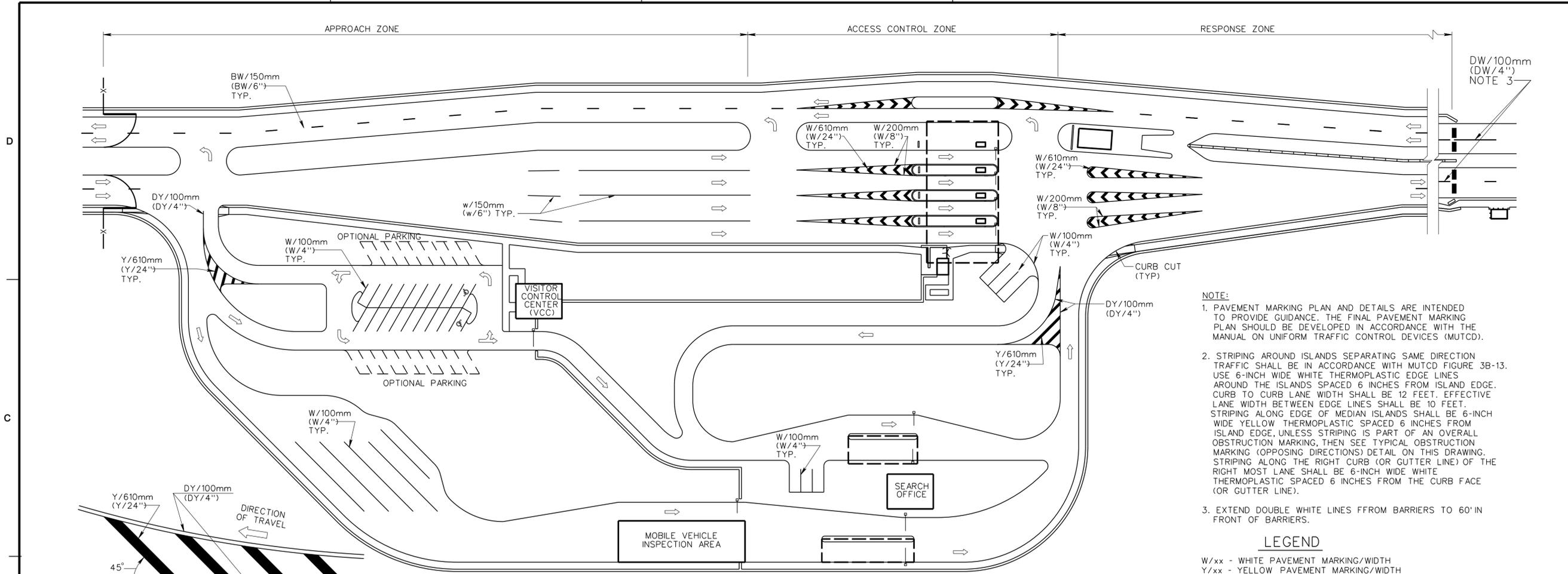
SHEET REFERENCE NUMBER
C9.13
SHEET 35 OF 60



TYPICAL ONE WAY INTERSECTION SIGNING
NOT TO SCALE



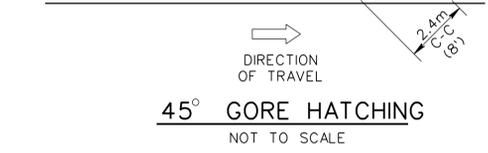
- NOTES:**
- FOR SPEEDS GREATER THAN 40 KPH (25 MPH), SEE CURRENT MUTCD FOR SIGN DIMENSIONS.
 - NO CLEARANCE SIGNS ARE REQUIRED FOR CANOPIES 15 FEET IN HEIGHT OR GREATER. FOR CANOPIES LESS THAN 15 FEET CONSULT SDDCTEA AND THE MUTCD.
 - CONSULT SDDCTEA FOR VEHICLE BARRIER SIGNING APPLICATIONS.
 - SIGN PLAN AND DETAILS ARE INTENDED TO PROVIDE GUIDANCE. THE FINAL SIGNING PLAN SHOULD BE DEVELOPED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
 - LOCATE SIGNS AT INTERSECTIONS PER MUTCD FIG. 2A-2.
 - FOR SIGNING AT ACTIVE VEHICLE BARRIERS, SEE THE FOLLOWING:
C9.10 FOR SIGNS AND SIGNALS SAFETY SYSTEM
C3.17 AND 18 FOR PRESENCE DETECTION SAFETY SYSTEM
C3.08 AND C3.16 FOR BARRIER NORMALLY CLOSED SAFETY SYSTEM



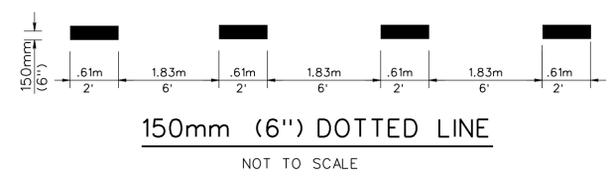
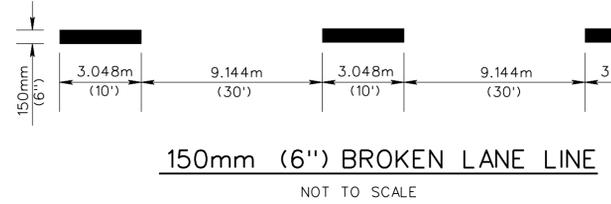
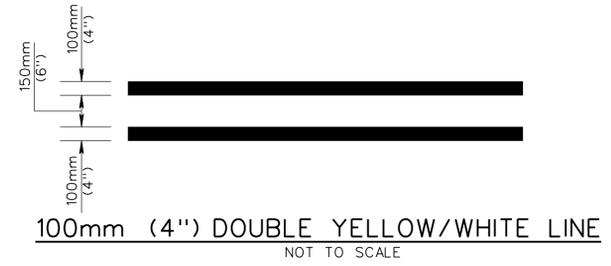
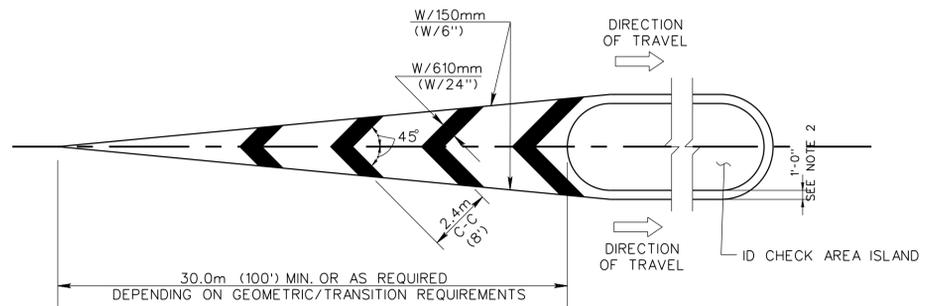
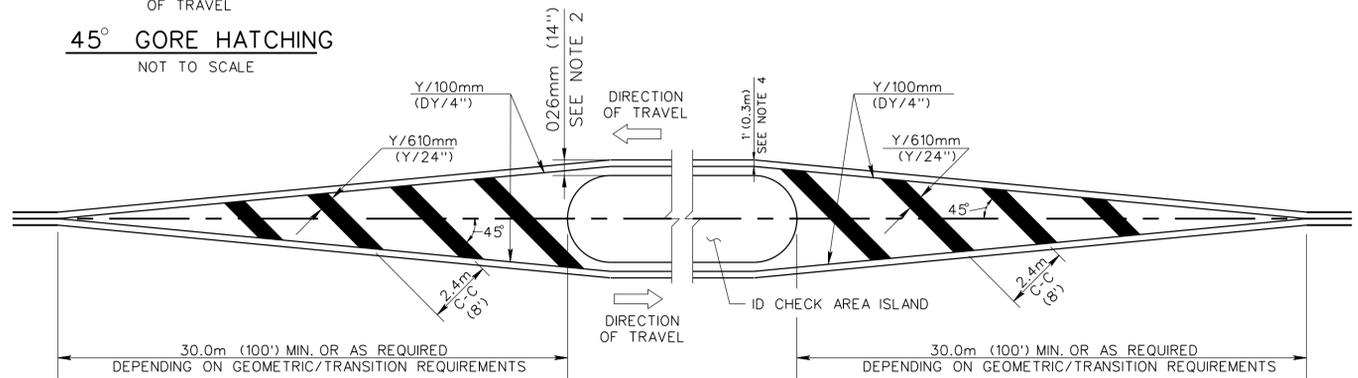
- NOTE:**
- PAVEMENT MARKING PLAN AND DETAILS ARE INTENDED TO PROVIDE GUIDANCE. THE FINAL PAVEMENT MARKING PLAN SHOULD BE DEVELOPED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
 - STRIPING AROUND ISLANDS SEPARATING SAME DIRECTION TRAFFIC SHALL BE IN ACCORDANCE WITH MUTCD FIGURE 3B-13. USE 6-INCH WIDE WHITE THERMOPLASTIC EDGE LINES AROUND THE ISLANDS SPACED 6 INCHES FROM ISLAND EDGE. CURB TO CURB LANE WIDTH SHALL BE 12 FEET. EFFECTIVE LANE WIDTH BETWEEN EDGE LINES SHALL BE 10 FEET. STRIPING ALONG EDGE OF MEDIAN ISLANDS SHALL BE 6-INCH WIDE YELLOW THERMOPLASTIC SPACED 6 INCHES FROM ISLAND EDGE, UNLESS STRIPING IS PART OF AN OVERALL OBSTRUCTION MARKING. (OPPOSING DIRECTIONS) DETAIL ON THIS DRAWING. STRIPING ALONG THE RIGHT CURB (OR GUTTER LINE) OF THE RIGHT MOST LANE SHALL BE 6-INCH WIDE WHITE THERMOPLASTIC SPACED 6 INCHES FROM THE CURB FACE (OR GUTTER LINE).
 - EXTEND DOUBLE WHITE LINES FROM BARRIERS TO 60' IN FRONT OF BARRIERS.

LEGEND

W/xx - WHITE PAVEMENT MARKING/WIDTH
 Y/xx - YELLOW PAVEMENT MARKING/WIDTH
 BW/xx - BROKEN WHITE PAVEMENT MARKING/WIDTH
 DY/xx - DOUBLE YELLOW PAVEMENT MARKING/WIDTH



TYPICAL ACP PAVEMENT MARKINGS
NOT TO SCALE



STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGEMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.

NO.	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
CHECKED BY: X.X.X.	SOLICITATION NO.: W819N07X-604
SUBMITTED BY: X.X.X.	CONTRACT NO.: X
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANS/D	PLOT SCALE: 1:1

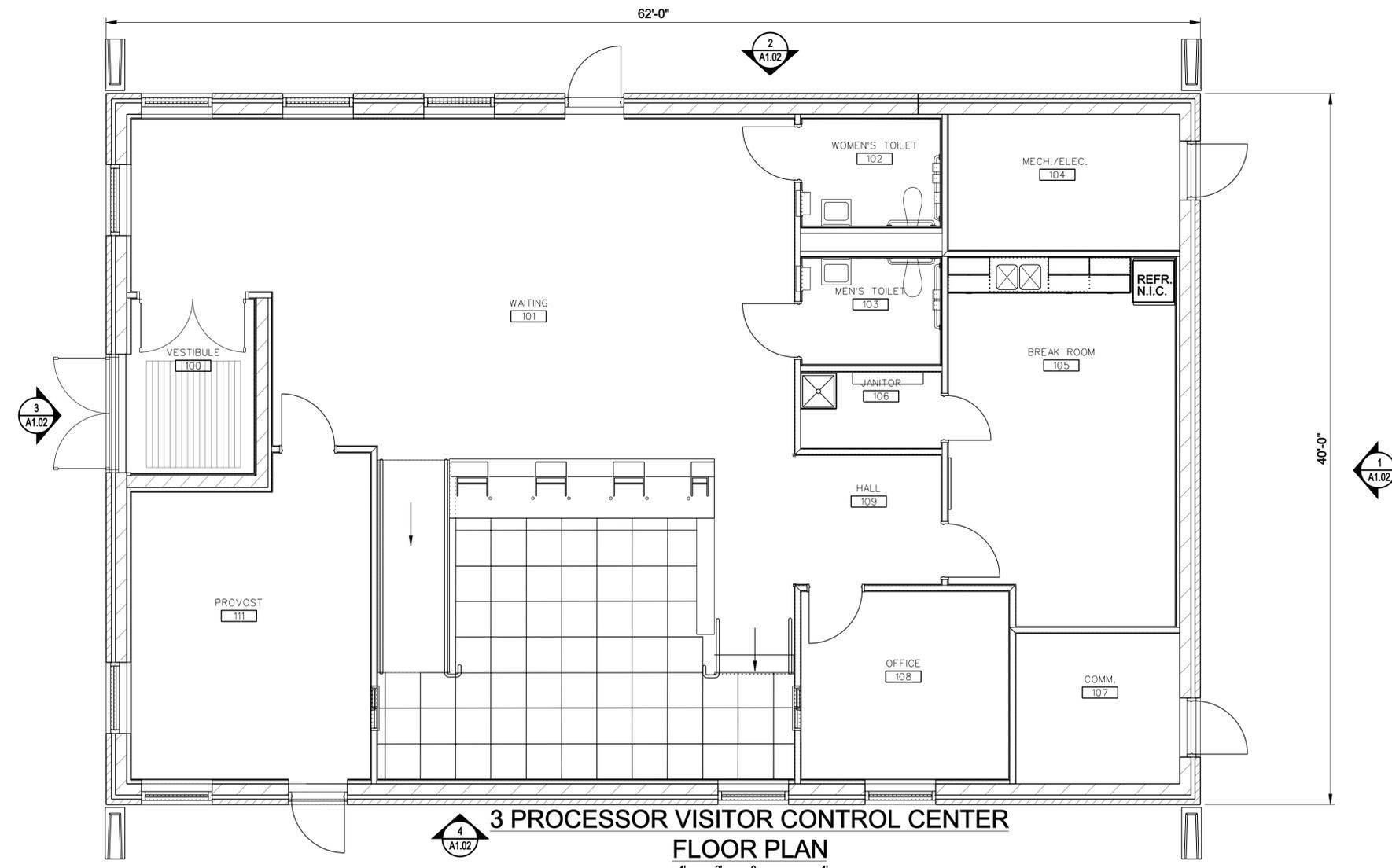
U. S. ARMY ENGINEER DISTRICT
 CORPS OF ENGINEERS
 OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
 ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
 PAVEMENT MARKING DETAILS

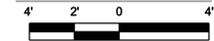
55CONSREQS
 55SYSTEMS
 55USERNAME\$S

1 2 3 4 5

D
C
B
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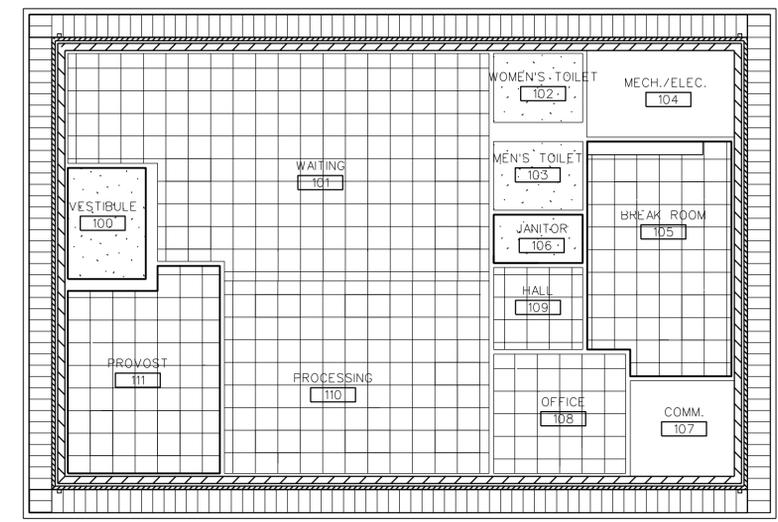
**3 PROCESSOR VISITOR CONTROL CENTER
FLOOR PLAN**



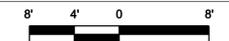
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GENERAL NOTES:

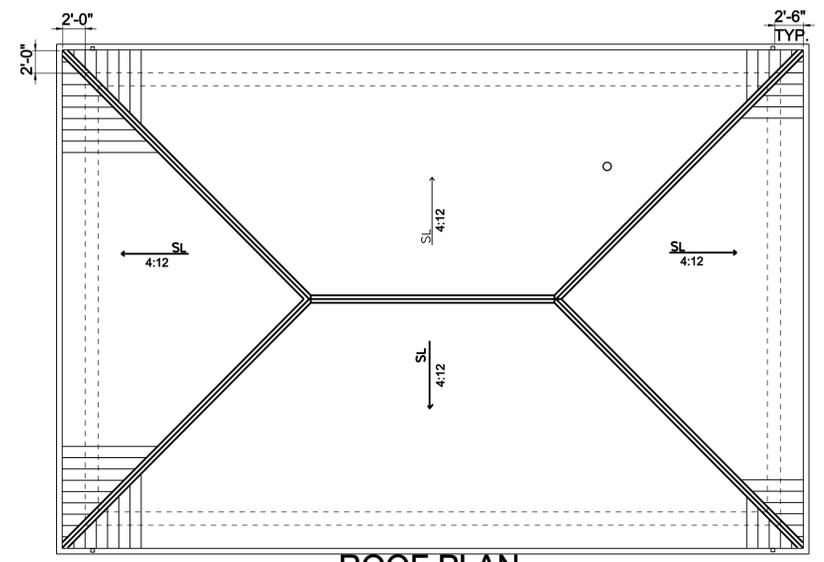
1. See BIM drawings for construction details. BIM drawings for Access Control Points are maintained by the Center of Standardization for Access Control Points (COS for ACPs) located in the Omaha District.
2. The VCC is the only building at the ACP that must meet the requirements of UFC 4-010-01 "DOD Minimum Antiterrorist Standards for Buildings". VCC's that are projected to have 11 or more people in them on a routine basis are considered to be Inhabited Buildings within an uncontrolled perimeter for the purposes of UFC 4-010-01. The COS for ACPs maintains designs for the following two types of VCC (note the following standoff distances apply only if the VCC will be routinely inhabited by 11 or more people):
 - a. VCC using conventional construction, which requires a standoff distance per UFC 4-010-01 of 82 feet from parking areas and roadways.
 - b. VCC using hardened construction, which requires a standoff distance of 50 feet from parking areas and roadways.
3. The VCC shown on this drawing includes spaces for 3 visitor processing stations. The COS for ACPs maintains VCC designs for 6 and 9 processing stations also. VCC dimensions are as follows:
 - a. VCC with 3 visitor processing stations - 62' x 40'
 - b. VCC with 6 visitor processing stations - 74' x 40'
 - c. VCC with 9 visitor processing stations - 86' x 40'
4. The VCC must be Americans with Disabilities Act (ADA) compliant.
5. Exterior masonry patterning and coursing to be determined during design.
6. Luminaire and diffuser types and locations to be determined during design.
7. All windows should be tinted.



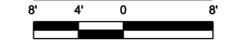
REFLECTED CEILING PLAN



SCALE: 1/8" = 1'-0"



ROOF PLAN



SCALE: 1/8" = 1'-0"



SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
DWN BY: X.X.X.	SOLICITATION NO.: W81FH07X6204
SUBMITTED BY: X.X.X.	CONTRACT NO.:
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANSI D	PLOT SCALE: 1:1
	PLOT DATE:

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
VISITOR CONTROL CENTER (VCC)
3 PROCESSOR VERSION
FLOOR PLAN

SHEET REFERENCE NUMBER
A1.01
SHEET 37 OF 60

\$\$\$CNSPEC04
\$\$\$SYSTEM05
\$\$\$USERNAME05

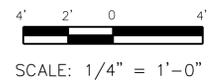
\$\$\$DGNPEC05
\$\$\$SYSTEM05
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SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.X	DATE: NOV 2007	SOLICITATION NO.: W15FH07X-6204	CONTRACT NO.:	CATEGORY CODE:	PILOT DATE:
DWN BY: X.X.X.X	CRD BY: X.X.X.X	W15FH07X-6204	X	X	.

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
VISITOR CONTROL CENTER (VCC)
3 PRECESSOR VERSION
BUILDING ELEVATIONS

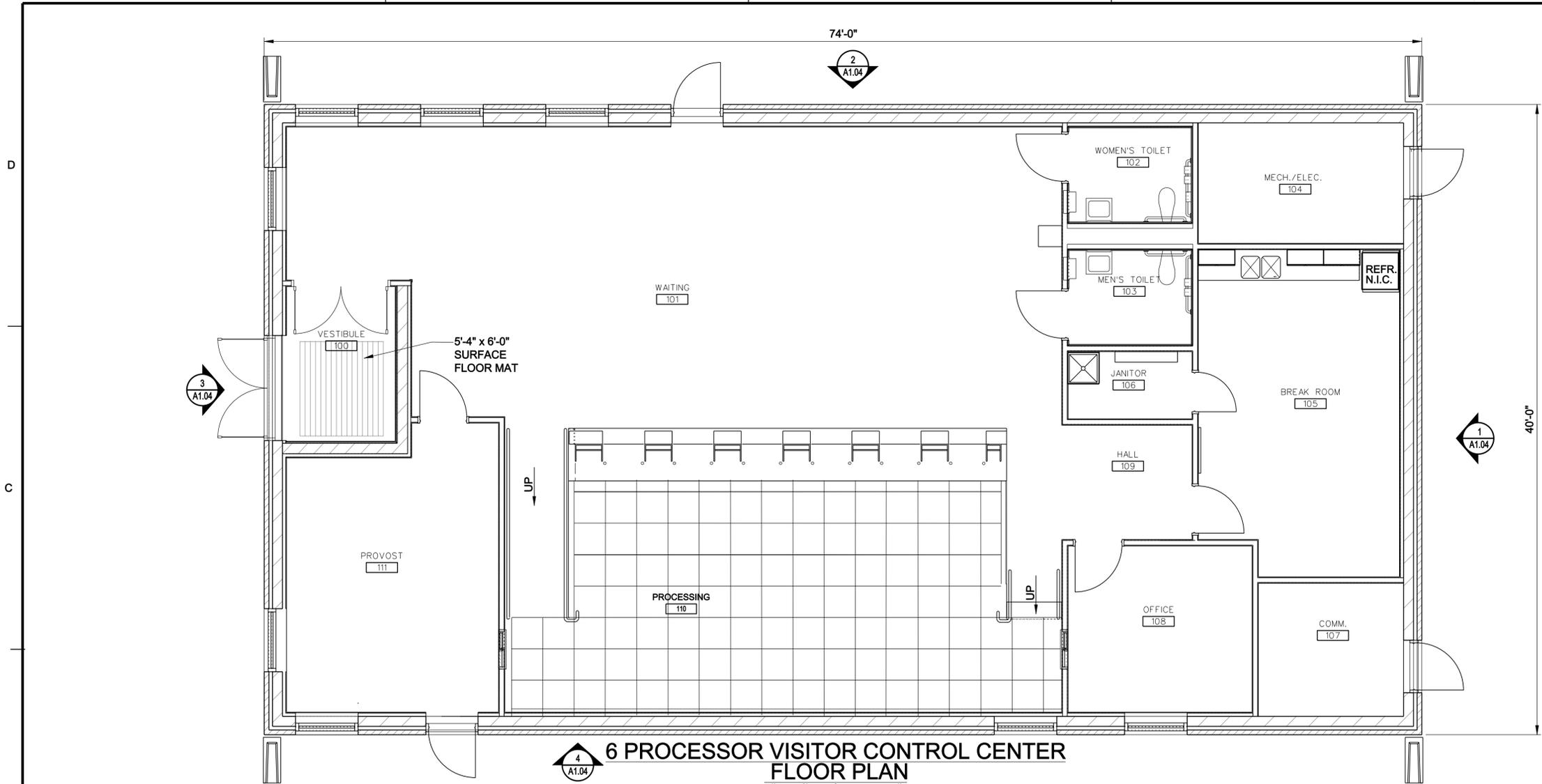
SHEET REFERENCE NUMBER
A1.02
SHEET 38 OF 60



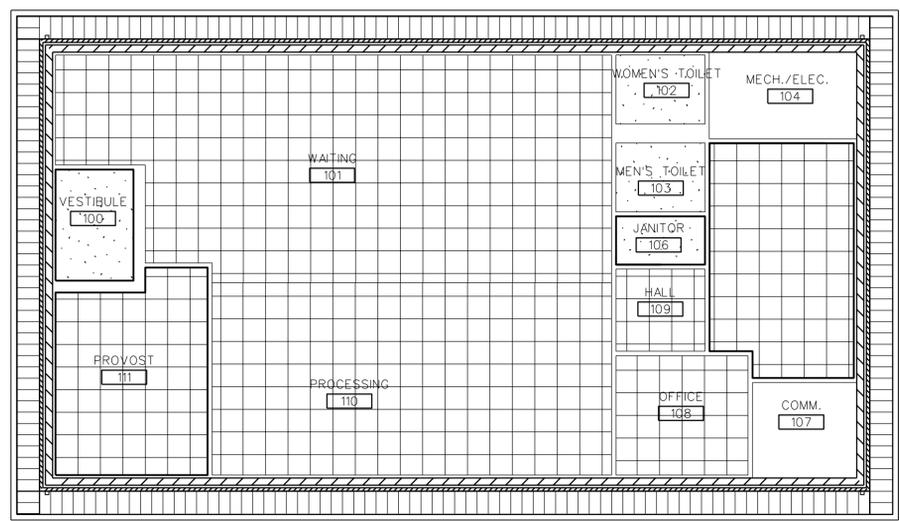
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\$\$\$SYSTEMS\$\$\$
\$\$\$USERNAME\$\$\$

\$\$\$DESIGNER\$\$\$
\$\$\$SYSTEMS\$\$\$
\$\$\$USERNAME\$\$\$

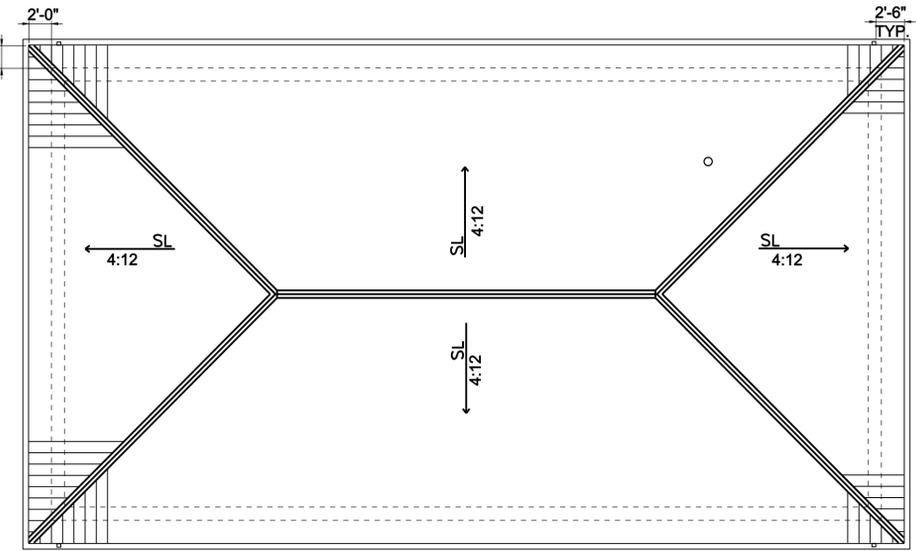
1 2 3 4 5



6 PROCESSOR VISITOR CONTROL CENTER FLOOR PLAN
 SCALE: 1/4" = 1'-0"



REFLECTED CEILING PLAN
 SCALE: 1/8" = 1'-0"



ROOF PLAN
 SCALE: 1/8" = 1'-0"

GENERAL NOTES:

1. See BIM drawings for construction details. BIM drawings for Access Control Points are maintained by the Center of Standardization for Access Control Points (COS for ACPs) located in the Omaha District.
2. The VCC is the only building at the ACP that must meet the requirements of UFC 4-010-01 "DOD Minimum Antiterrorist Standards for Buildings". VCC's that are projected to have 11 or more people in them on a routine basis are considered to be Inhabited Buildings within an uncontrolled perimeter for the purposes of UFC 4-010-01. The COS for ACPs maintains designs for the following two types of VCC (note the following standoff distances apply only if the VCC will be routinely inhabited by 11 or more people):
 - a. VCC using conventional construction, which requires a standoff distance per UFC 4-010-01 of 82 feet from parking areas and roadways.
 - b. VCC using hardened construction, which requires a standoff distance of 50 feet from parking areas and roadways.
3. The VCC shown on this drawing includes spaces for 3 visitor processing stations. The COS for ACPs maintains VCC designs for 6 and 9 processing stations also. VCC dimensions are as follows:
 - a. VCC with 3 visitor processing stations - 62' x 40'
 - b. VCC with 6 visitor processing stations - 74' x 40'
 - c. VCC with 9 visitor processing stations - 86' x 40'
4. The VCC must be Americans with Disabilities Act (ADA) compliant.
5. Exterior masonry patterning and coursing to be determined during design.
6. Luminaire and diffuser types and locations to be determined during design.
7. All windows should be tinted.



SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
DWN BY: X.X.X.	SOLICITATION NO.: W812HJ-07-X-6204
SUBMITTED BY: X.X.X.	CONTRACT NO.:
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANSI D	PLOT SCALE: 1:1
	PLOT DATE:

U. S. ARMY ENGINEER DISTRICT
 CORPS OF ENGINEERS
 OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
 ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
 VISITOR CONTROL CENTER (VCC)
 6 PROCESSOR VERSION
 FLOOR PLAN

SHEET REFERENCE NUMBER
A1.03
 SHEET 39 OF 60

\$\$\$CNSPEC04
 \$\$\$SYSTEM\$\$
 \$\$\$USERNAME\$\$\$

\$\$\$CNSPEC04
 \$\$\$SYSTEM\$\$
 \$\$\$USERNAME\$\$\$

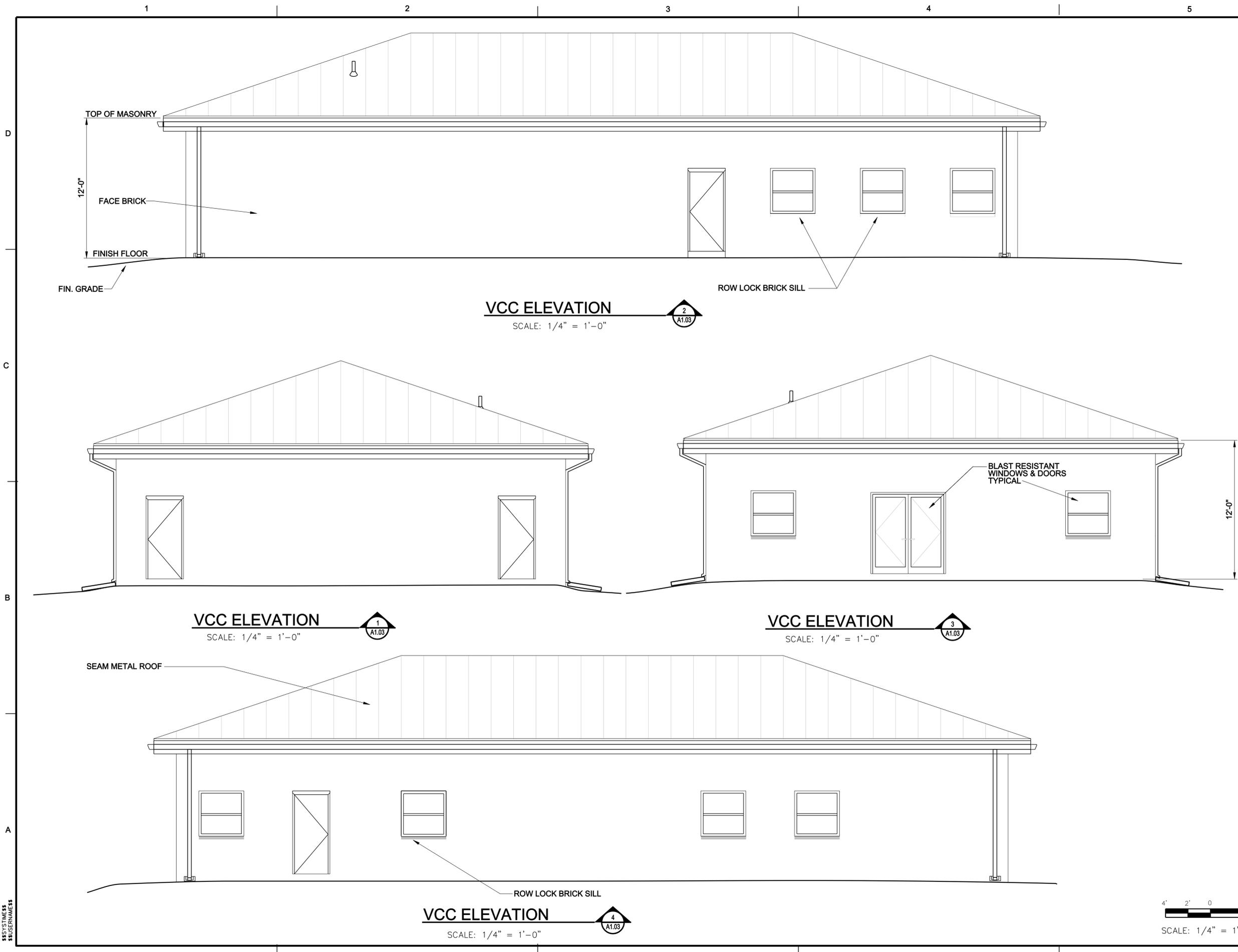
SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
DWN BY: X.X.X.	SOLICITATION NO.: W912HJ-07-X-6204
SUBMITTED BY: X.X.X.	CONTRACT NO.:
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANSI D	PLOT SCALE: 1:1
	PLOT DATE:

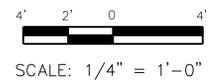
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
VISITOR CONTROL CENTER (VCC)
6 PROCESSOR VERSION
BUILDING ELEVATIONS

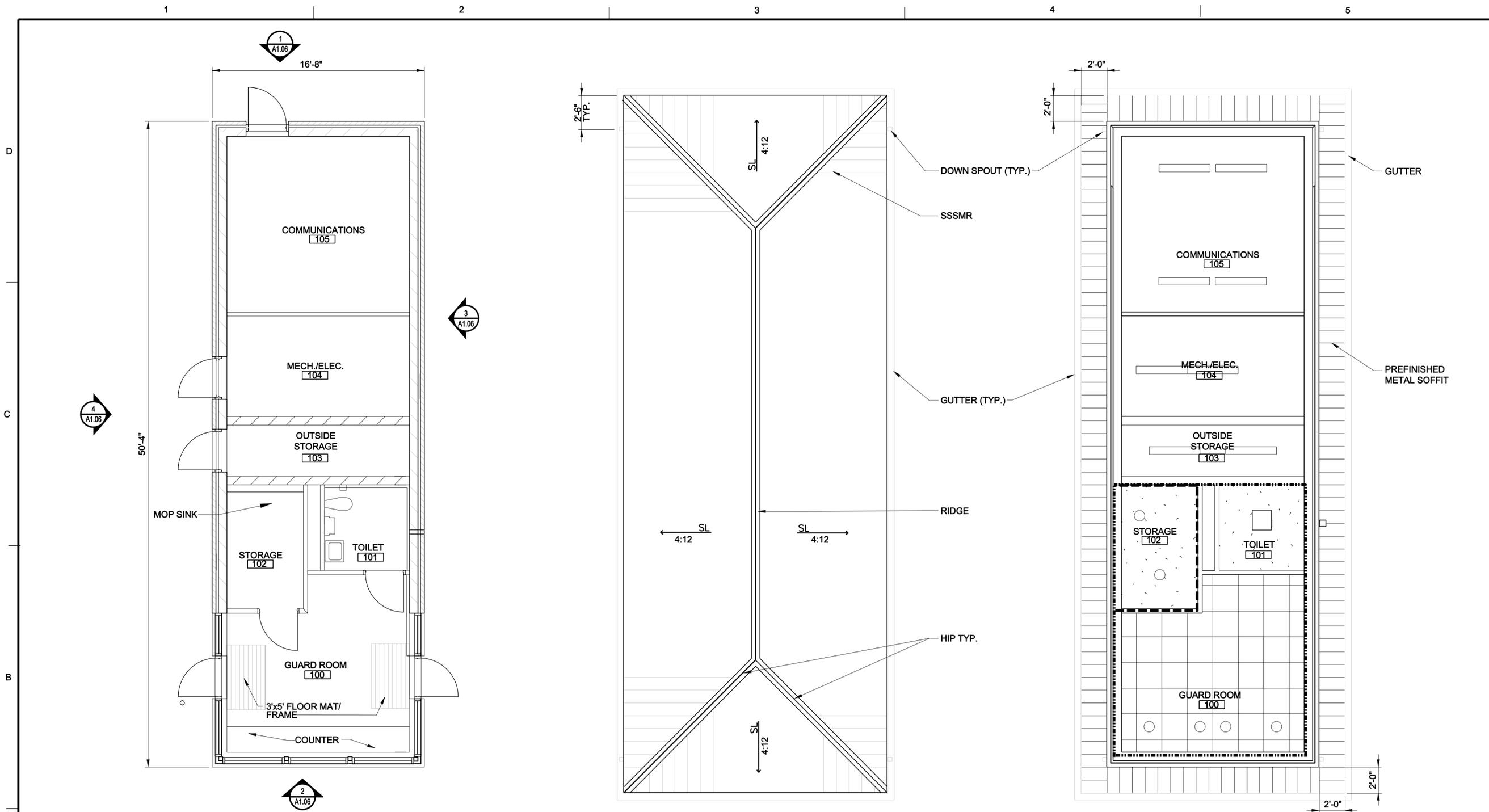
SHEET REFERENCE NUMBER
A1.04
SHEET 40 OF 60



\$\$\$DGN\$PEC\$\$
\$\$\$SYTIME\$\$
\$\$\$USERNAME\$\$



\$\$\$DGN\$PEC\$\$
\$\$\$SYTIME\$\$
\$\$\$USERNAME\$\$



FLOOR PLAN
SCALE: 1/4" = 1'-0"

ROOF PLAN
SCALE: 1/4" = 1'-0"

REFLECTED CEILING PLAN
SCALE: 1/4" = 1'-0"

GENERAL NOTES:

1. See BIM drawings for construction details. BIM drawings for Access Control Points are maintained by the Center of Standardization for Access Control Points (COS for ACPs) located in the Omaha District.
2. The building, doors, widows, and frames around the guard areas shall meet Level 3 Ballistics Standard UL-752 as a minimum.
3. Exterior masonry patterning and coursing to be determined during design.
4. Luminaire and diffuser types and locations to be determined during design.
5. All windows should be tinted. Interior surfaces in the Gatehouse should be dark in color.

LEGEND:

- GWB CEILING
- 2 X 2 ACOUSTICAL CEILING TILE
- ONE-HOUR FIRE RATED WALL & CEILING
- BULLET RESISTANT WALL

SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: XXX	DATE: 10/20/2018
DWN BY: XXX	SOLICITATION NO.: W15FH07X-6204
APP BY: XXX	CONTRACT NO.:
SUBMITTED BY: XXX	CATEGORY CODE: X
FILE NAME: 8001A005.dgn	PLANT DATE: 3/11/2019
SIZE: 9 3/16" x 11 1/2" in.	
ANSI: 2	

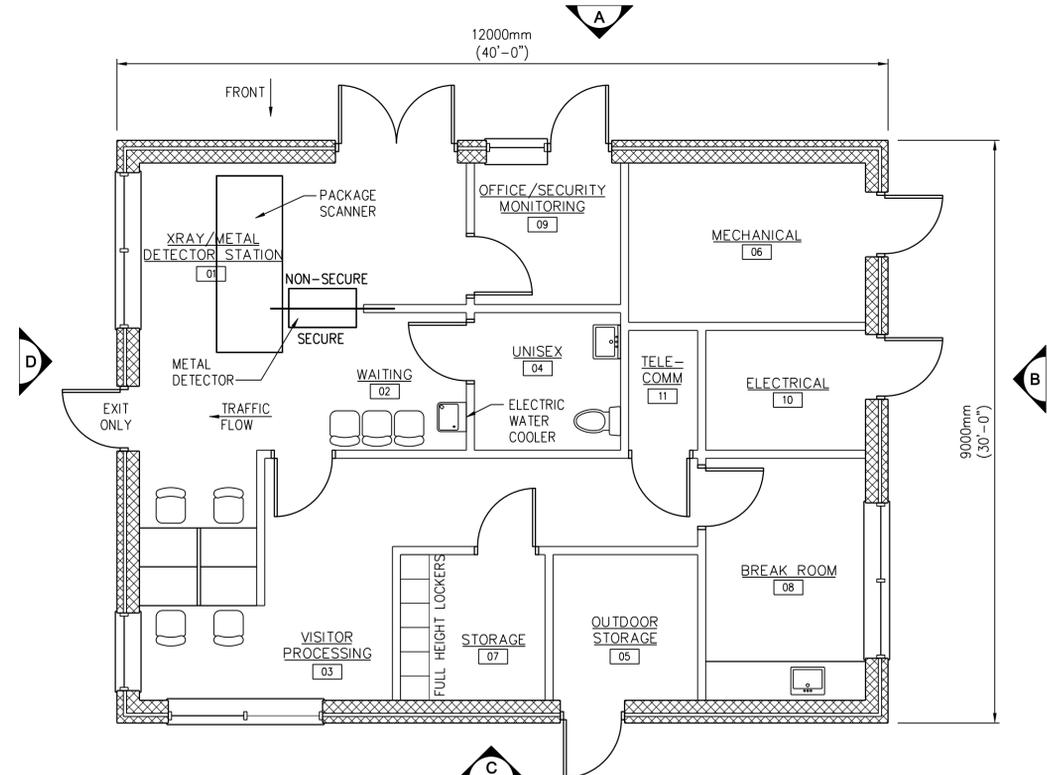
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
GATEHOUSE
FLOOR PLAN, REFLECTED CEILING PLAN & ROOF PLAN

\$\$\$CONTRACTOR\$\$\$
\$\$\$SYSTEMS\$\$\$
\$\$\$USERNAME\$\$\$

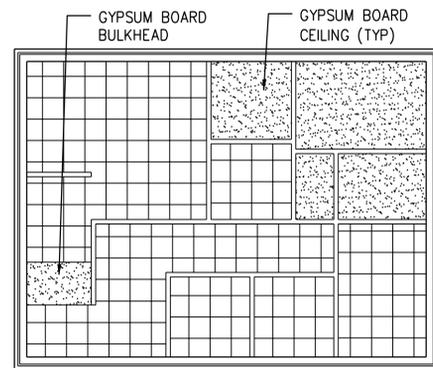
GENERAL NOTES

1. LINEAR DIMENSION REFERENCES ARE BASED ON THE RECOGNIZED BUILDING DESIGN MODULE OF 100mm = 4".
2. LOCATE INTERIOR DOOR FRAMES 4" FROM THE OUTSIDE FACE OF THE DOOR FRAME TO THE NEAREST INSIDE WALL CORNER UNLESS NOTED OTHERWISE.
3. LIGHTS AND DIFFUSERS ARE NOT SHOWN ON THE REFLECTED CEILING PLAN. QUANTITY AND LOCATIONS TO BE DETERMINED DURING DESIGN.
4. EXTERIOR MASONRY PATTERNING AND COURSING TO BE DETERMINED DURING DESIGN.
5. THE SEARCH OFFICE WILL INCLUDE A CONTROL CONSOLE WITH CCTV MONITORS, AN ANNUNCIATION PANEL, AND COMMUNICATIONS TO THE INSTALLATION'S CENTRAL SECURITY MONITORING STATION.
6. SIZE WAITING AREA FOR EXPECTED NUMBER OF SEARCHED VEHICLES.



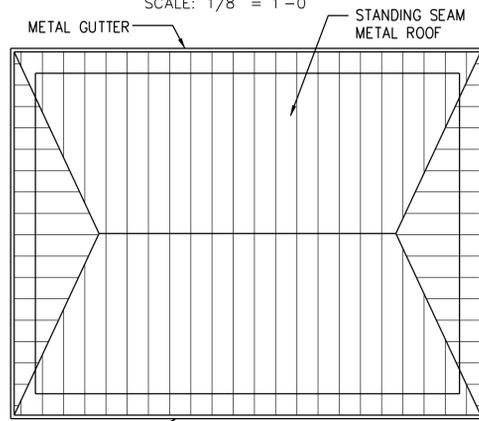
SEARCH OFFICE WITH PACKAGE SCANNER AND METAL DETECTOR FLOOR PLAN

SCALE: 1/4" = 1'-0"



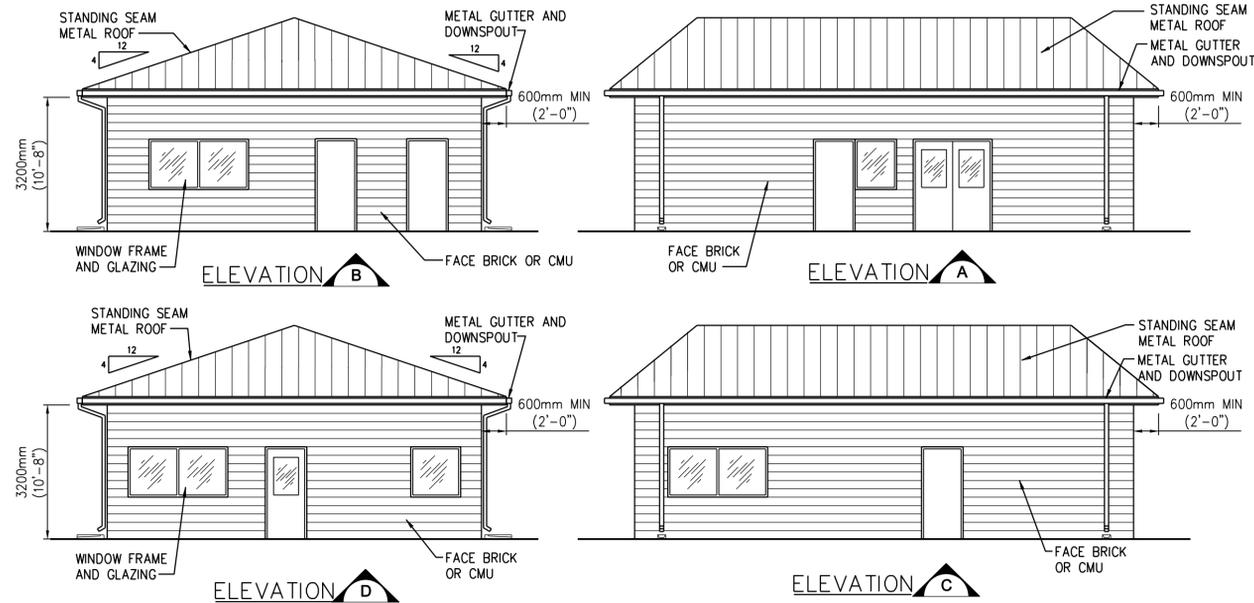
SEARCH OFFICE WITH PACKAGE SCANNER AND METAL DETECTOR REFLECTED CEILING PLAN

SCALE: 1/8" = 1'-0"



SEARCH OFFICE WITH PACKAGE SCANNER AND METAL DETECTOR ROOF PLAN

SCALE: 1/8" = 1'-0"



SEARCH OFFICE WITH PACKAGE SCANNER AND METAL DETECTOR ELEVATIONS

SCALE: 1/8" = 1'-0"



SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
DWN BY: X.X.X.	SOLICITATION NO.: W915N-D7-X-604
SUBMITTED BY: X.X.X.	CONTRACT NO.:
FILE NAME: X.X.X.	CATEGORY CODE: X
SIZE: ANS I	PLOT SCALE: 1:1
	PLOT DATE: .

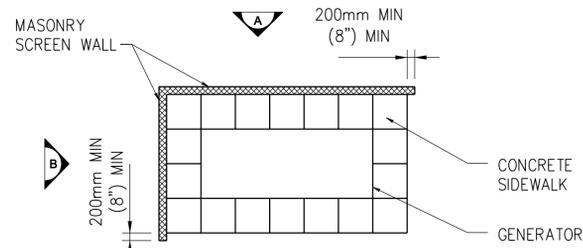
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
ARCHITECTURAL
SEARCH OFFICE WITH PACKAGE SCANNER
AND METAL DETECTOR

SHEET REFERENCE NUMBER
A1.07
SHEET 43 OF 60

GENERAL NOTES

1. LIGHTS AND DIFFUSERS ARE NOT SHOWN ON THE SOFFIT PLAN. QUANTITY AND LOCATIONS TO BE DETERMINED DURING DESIGN.
2. CANOPIES MUST PROVIDE 15'-0" VERTICAL CLEARANCE ABOVE FINISHED ROADWAY SURFACE. IF A LARGE NUMBER OF OVERHEIGHT VEHICLES ARE EXPECTED, PROVIDE 17'-0" VERTICAL CLEARANCE ABOVE ROADWAY SURFACE.
3. BOLLARDS OR OTHER COLUMN PROTECTION MEASURES SHOULD BE PLACED AS REQUIRED.
4. CANOPY COLUMNS TO BE PLACED 5'-0" FROM THE EDGE OF THE CURB.
5. CANOPY WIDTH DETERMINED BY ADDING THE LANES, COLUMN SETBACKS, AND CANOPY OVERHANG.
6. CANOPIES WILL BE CONSTRUCTED SO COLUMNS DO NOT OBSTRUCT GUARD'S LINE OF SIGHT.

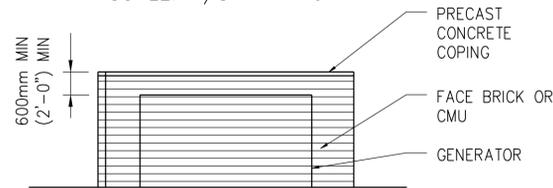


NOTE: DIMENSIONS OF SCREEN WALL TO BE DETERMINED BASED ON SELECTED GENERATOR

GENERATOR SCREEN WALL PLAN



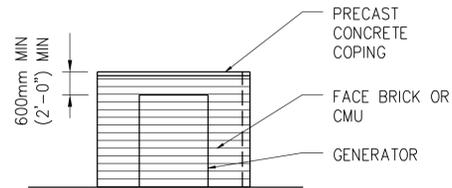
SCALE: 1/8" = 1'-0"



ELEVATION A



SCALE: 1/8" = 1'-0"

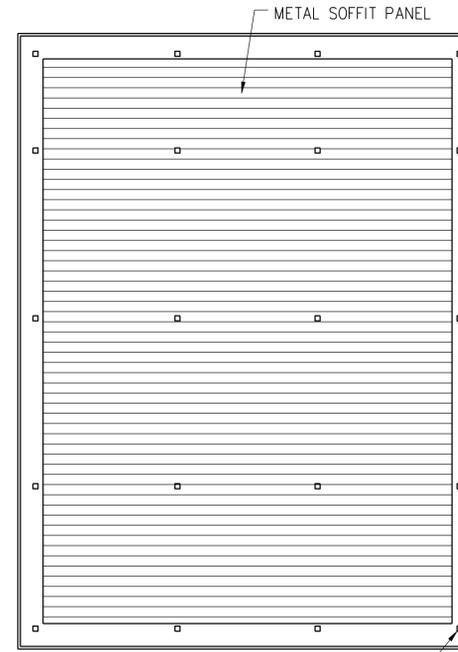


ELEVATION B

GENERATOR SCREEN WALL ELEVATIONS



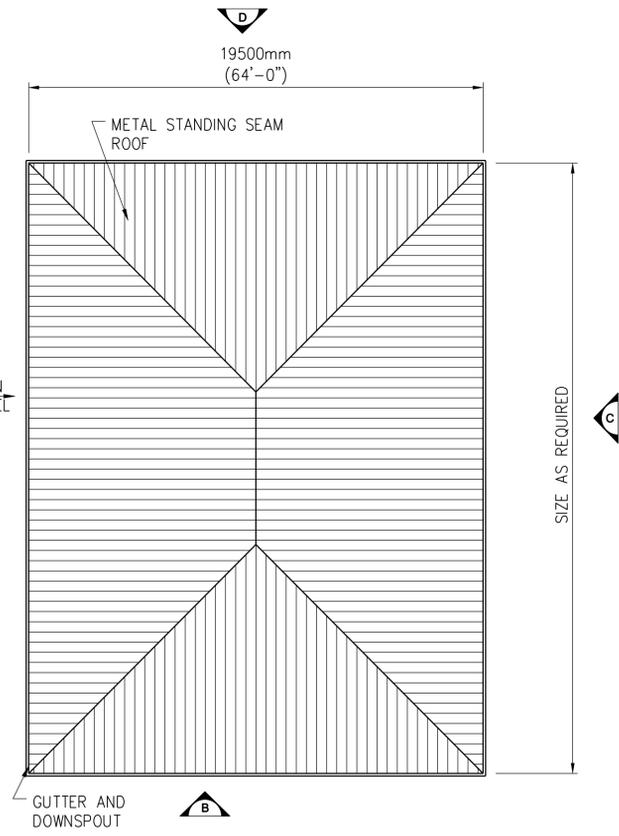
SCALE: 1/8" = 1'-0"



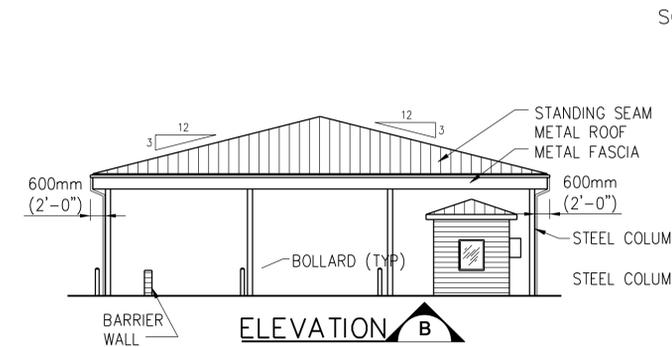
CANOPY SOFFIT PLAN



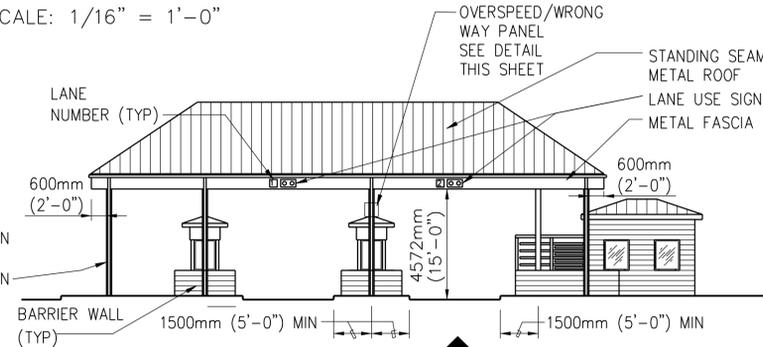
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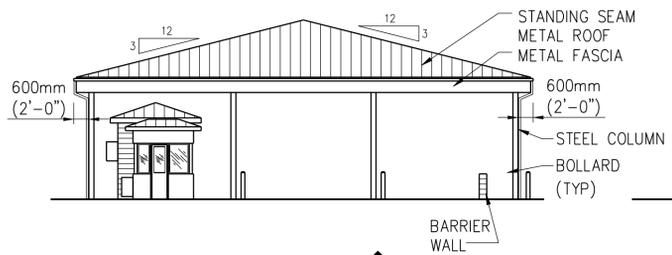
CANOPY ROOF PLAN



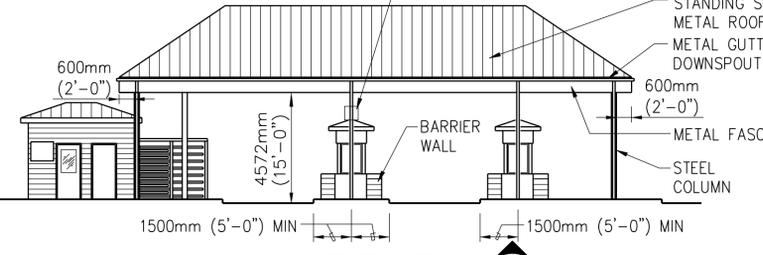
ELEVATION B



ELEVATION A



ELEVATION D



ELEVATION C

ID CHECK AREA CANOPY ELEVATIONS



SCALE: 1/16" = 1'-0"



SYMBOL	DESCRIPTION	DATE	BY

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DWN BY: XXX	SOLICITATION NO.: W15FH107X-6204
SUBMITTED BY: XXX	CONTRACT NO.: X
FILE NAME: X	CATEGORY CODE: X
SIZE: ANS/D	PLOT SCALE: 1:1
	PLOT DATE: X

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
ARCHITECTURAL
ID CHECK AREA CANOPY

SHEET REFERENCE NUMBER
A1.10
SHEET 46 OF 60

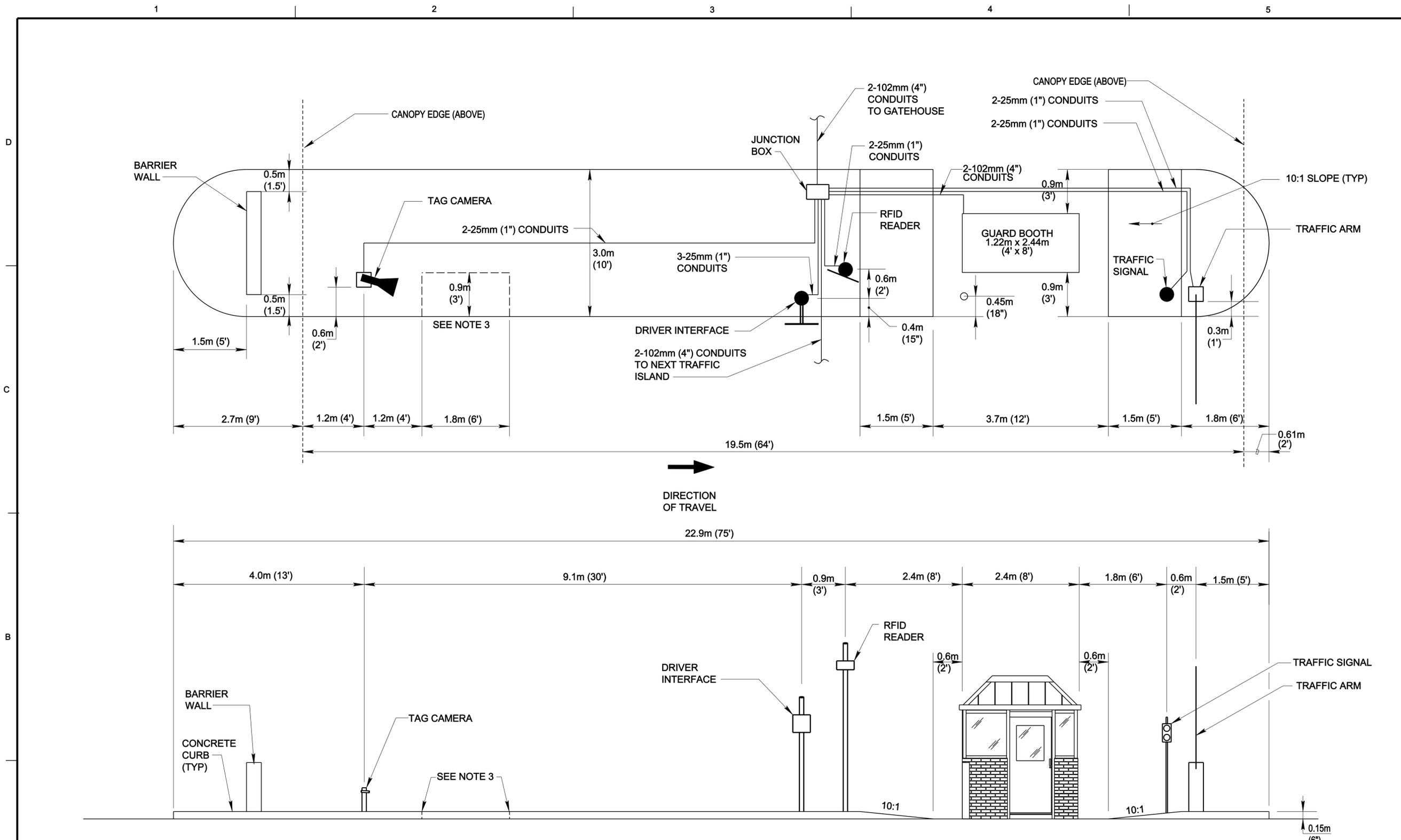
NO.	DATE	DESCRIPTION	BY

DESIGNED BY: X.X.X.	DATE: NOV 2007
DWN BY: X.X.X.	SOLICITATION NO.: W912HJ-07-X-6204
SUBMITTED BY: X.X.X.	CONTRACT NO.: X
FILE NAME: X	CATEGORY CODE: X
SIZE: ANS I D	PLOT DATE: .
PLOT SCALE: 1:1	

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
CONDUIT PLAN
WITH AUTOMATION AND NO ISLAND

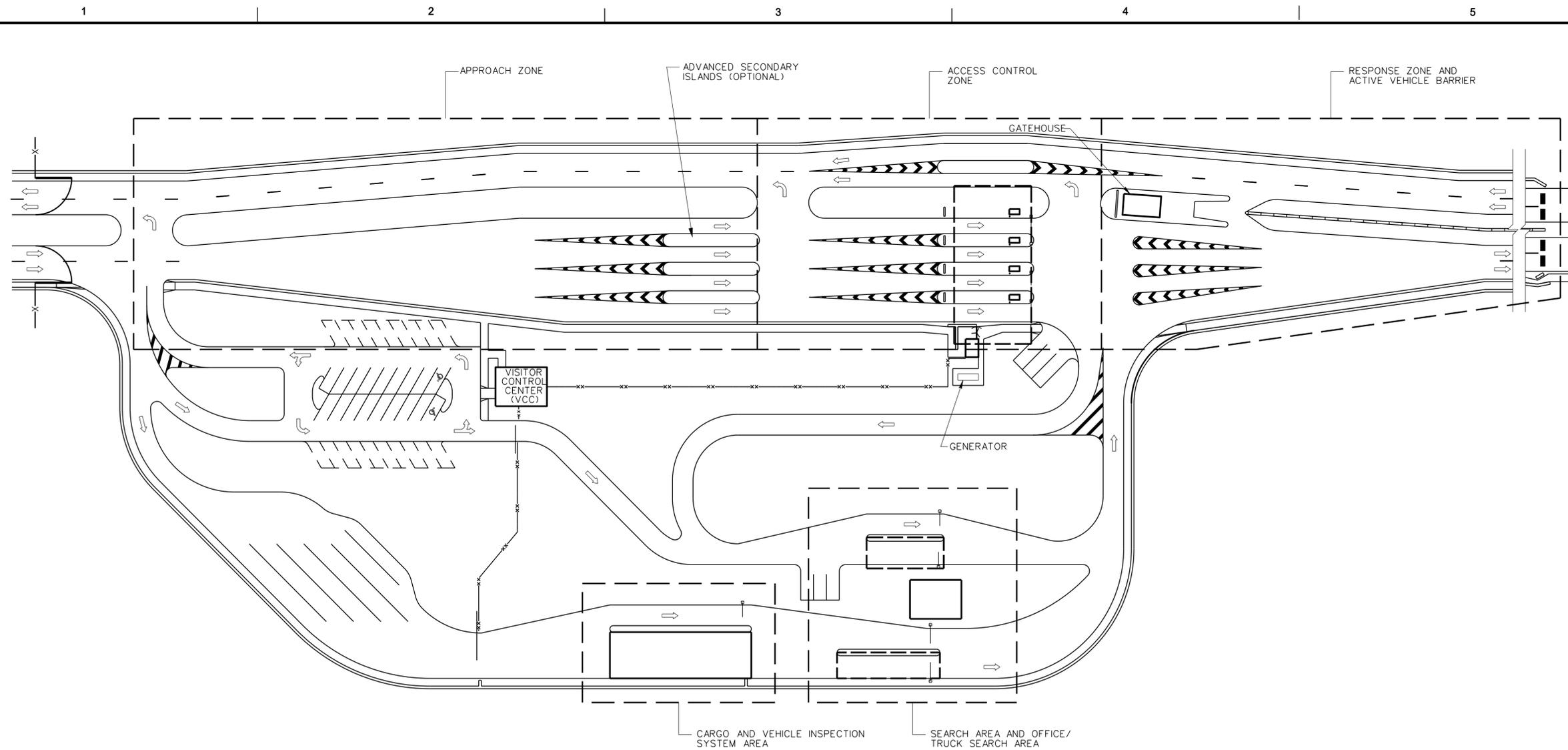
SHEET REFERENCE NUMBER
EL.03
SHEET 50 OF 60



- NOTES:**
1. DEVICE LOCATIONS SHOWN ARE ADVISORY, EXCEPT THE DISTANCE BETWEEN THE GATE ARM AND THE DRIVER INTERFACE PEDESTAL SHOULD BE 27' AS SHOWN. FOR EXISTING ACPs WITH SHORTER TRAFFIC ISLANDS, THIS DISTANCE SHALL BE A MINIMUM OF 16 FEET.
 2. FOR EXISTING ACPs WITH TRAFFIC ISLANDS SHORTER THAN 75 FEET, EVALUATE EXISTING CONDITIONS TO DETERMINE THE OPTIMAL LOCATION OF THE REAR TAG CAMERA TO ENSURE PROPER COVERAGE.
 3. A CURB CUTOUT FOR THE TANDEM GUARD IS OPTIONAL. IF PROVIDED, CUTOUT SHALL BE 3' DEEP BY 6' WIDE AS SHOWN AND SHALL HAVE VERTICAL FACES.
 4. DESIGN MAY VARY TO FIT EXISTING CONDITIONS.

CONDUIT PLAN
TRAFFIC ISLAND WITH AUTOMATION
GUARD BOOTH NOT ON ISLAND
NOT TO SCALE

\$\$\$CONCEPTS
\$\$\$SYSTEMS
\$\$\$USERNAME\$\$\$



POWER REQUIREMENTS
NOT TO SCALE

AREA	VA - CONNECTED			VA - DEMAND		
	UTILITY	GENERATOR	UPS	UTILITY	GENERATOR	UPS
APPROACH ZONE	7120.0	7120.0	2400.0	7120.0	7120.0	2400.0
ADVANCE (SECONDARY) ISLANDS	6240.0	6240.0	1200.0	1440.0	1440.0	1200.0
ACCESS CONTROL ZONE	32632.2	23919.2	9020.0	16992.2	16079.2	5980.0
GATEHOUSE	15184.6	8343.6	6934.0	11704.6	8343.6	6934.0
RESPONSE ZONE AND ACTIVE VEHICLE BARRIER	22578.0	22578.0	18550.0	4098.0	4098.0	70.0
OVERWATCH POSITION	2430.8	1276.8	1056.0	1710.8	1276.8	1056.0
VISITOR CONTROL CENTER (VCC)	24730.2	8555.2	3864.0	15740.2	8555.2	3864.0
SEARCH AREA AND OFFICE	38860.2	25685.2	6180.0	30910.2	23725.2	5420.0
TRUCK SEARCH AREA	8482.0	8482.0	830.0	7722.0	7722.0	70.0
CARGO AND VEHICLE INSPECTION SYSTEM AREA	100000.0	0.0	0.0	100000.0	0.0	0.0
ALL	258258.0	112200.0	50034.0	197438.0	78360.0	26994.0

- NOTES:
1. POWER REQUIREMENTS PER ACP CRITERIA REQUIREMENTS AND STANDARD DRAWINGS.
 2. BACKUP POWER & UPS REQUIREMENTS PER ACP CRITERIA (APPENDIX B).
 3. DESIGNER TO VERIFY UPS INTERFACE CAPABILITIES.
 4. PHYSICAL LOCATION(S) AND SIZE OF UPS(S) SHALL BE DETERMINED BY THE ELECTRICAL DESIGNER.
 5. SEE APPENDIX F FOR DETAILED LIST OF ELECTRICAL LOADS.



SYMBOL	DESCRIPTION	DATE	BY

DESIGNED BY: X.X.X.X	DATE: NOV 2007	SOLICITATION NO.: W15FH07X-604	CONTRACT NO.:
DWN BY: X.X.X.X	CHK BY: X.X.X.X	FILE NAME: X.X.X.X	CATEGORY CODE: X.X.X.X
SUBMITTED BY: X.X.X.X	PILOT SCALE: 1:1	PILOT DATE:	
SIZE: ANSI D			

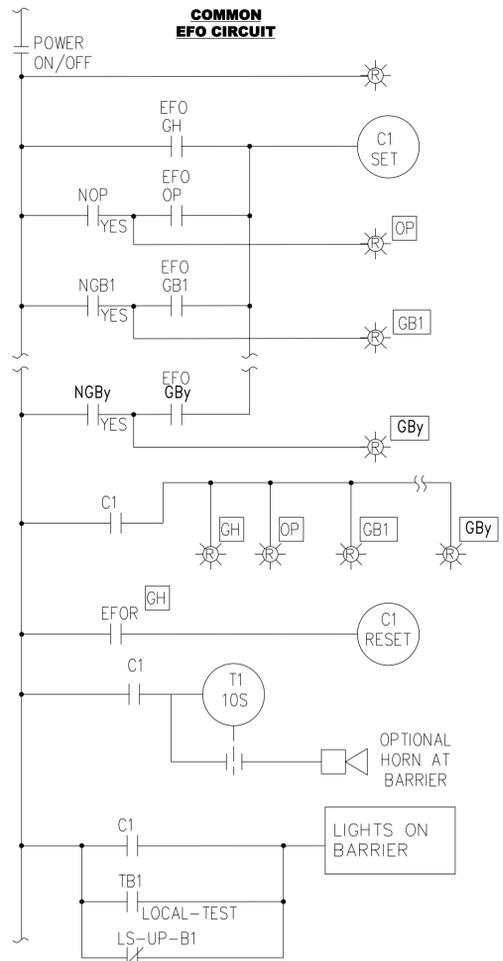
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA DISTRICT

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
ELECTRICAL PLAN
POWER REQUIREMENTS

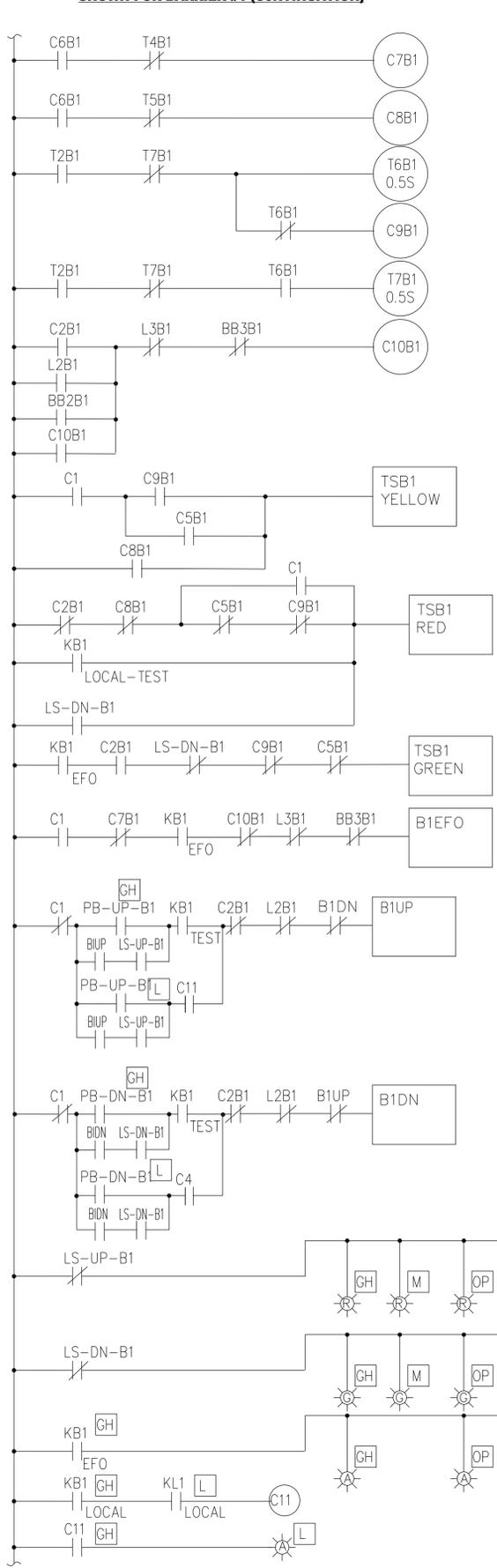
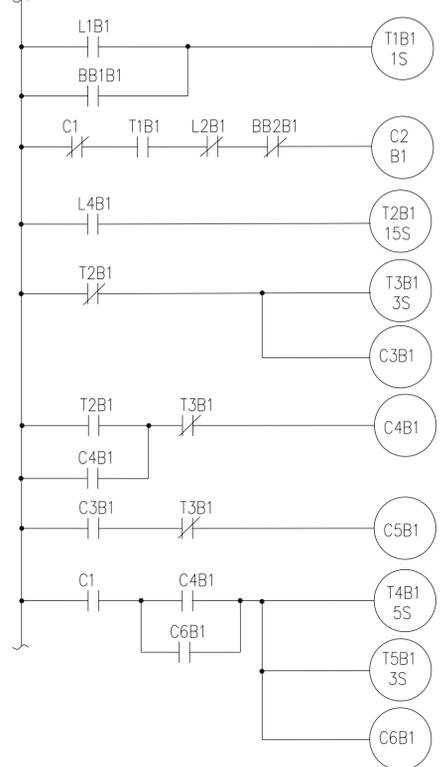
SHEET
REFERENCE
NUMBER
E1.02
SHEET 54 OF 60

\$\$\$CONSREQS
\$\$\$SYSTEMS
\$\$\$USERNAME\$\$\$

STANDARDS DEVELOPED UTILIZING COMMON ENGINEERING AND ARCHITECTURAL RESOURCES. ENGINEERING JUDGMENT APPLIED WHERE APPROPRIATE. ALL FEATURES AND DIMENSIONS SHOULD BE VALIDATED AND ADJUSTED AS APPROPRIATE AS PART OF THE DESIGN PROCESS.



TYPICAL BARRIER CONTROLS SHOWN FOR BARRIER #1



DEVICE LEGEND

- BB1Bx BREAK BEAM SENSOR #1 IN FRONT OF BARRIER'S STOP LINE.
- BB2Bx BREAK BEAM SENSOR #2 IN BACK OF STOP LINE BUT IN FRONT OF BARRIER.
- BB3Bx BREAK BEAM SENSOR #3 IN BACK OF BARRIER.
- BxUP BARRIER UP (CLOSE) ACTUATOR.
- BxDN BARRIER DOWN (OPEN) ACTUATOR.
- BxEFO BARRIER EFO ACTUATOR.
- C1 EFO INITIATION RELAY WITH BOTH SET AND RESET COILS.
- C2Bx CONTROL RELAY TO CONTROL TRAFFIC SIGNAL.
- C3Bx CONTROL RELAY FOR QUEUE MODE.
- C4Bx CONTROL RELAY THAT PICKS-UP AT BEGINNING OF QUEUE (T2 TIMES OUT), AND DROPS OUT 3 SECONDS AFTER QUEUE ENDS (T3 TIMES OUT).
- C5Bx CONTROL RELAY THAT PICKS-UP AT END OF QUEUE (T2 DROPS OUT AND PICKS UP C3), AND DROPS OUT 3 SECONDS LATER (T3 TIMES OUT).
- C6Bx CONTROL RELAY FOR EFO PREEMPTION DURING QUEUE MODE.
- C7Bx CONTROL RELAY THAT PICKS UP WHEN THERE IS AN EFO ACTUATION (C1) DURING THE PERIOD OF THE QUEUE PLUS 3 SECONDS AFTER THE QUEUE ENDS (C4). DROPS OUT 5 SECONDS LATER (T4 TIMES OUT).
- C8Bx CONTROL RELAY THAT PICKS UP WHEN THERE IS AN EFO ACTUATION (C1) DURING THE PERIOD OF THE QUEUE PLUS 3 SECONDS AFTER THE QUEUE ENDS (C4). DROPS OUT 3 SECONDS LATER (T5 TIMES OUT).
- C9Bx CONTROL RELAY TO CONTROL FLASHING YELLOW ON TRAFFIC SIGNAL.
- C10Bx CONTROL RELAY TO SUPPRESS BARRIER CLOSURE WHEN VEHICLE IS PRESENT.
- C11 CONTROL RELAY FOR LOCAL MODE.
- EFO-a EFO CONTROL SWITCH WITH MOMENTARY CONTACT. "a" DENOTES LOCATION, GH (GATEHOUSE), OP (OVERWATCH POSITION), GBy GUARD BOOTH # y).
- EFOR EFO RESET CONTROL SWITCH WITH MOMENTARY CONTACT.
- KBx BARRIER MODE SELECTOR SWITCH WITH LOCAL-EFO-TEST MODES FOR BARRIER #1. MAINTAINED CONTACTS. KEY OPERATED WITH UNIQUE KEY REMOVABLE IN THE LOCAL POSITION ONLY.
- KL1 MODE SELECTOR SWITCH WITH AUTO-LOCAL MODES FOR BARRIER x OPERATED BY SAME KEY THAT OPERATES KBx.
- L1Bx INDUCTION LOOP SENSOR #1 IN FRONT OF BARRIER'S STOP LINE.
- L2Bx INDUCTION LOOP SENSOR #2 IN BACK OF STOP LINE BUT IN FRONT OF BARRIER.
- L3Bx INDUCTION LOOP SENSOR #3 IN BACK OF BARRIER.
- L4Bx INDUCTION LOOP SENSOR #4 FOR QUEUE INITIATION.
- LS-UP-Bx UP (CLOSED) LIMIT SWITCH ON BARRIER. CONTACT POSITION SHOWN (OPEN OR CLOSED) WHEN THE BARRIER IS IN THE FULLY UP POSITION.
- LS-DN-Bx DOWN (OPEN) LIMIT SWITCH ON BARRIER. CONTACT POSITION SHOWN (OPEN OR CLOSED) IS WHEN THE BARRIER IS IN THE FULLY DOWN POSITION.
- NGBy EFO ARMED YES-NO SELECTOR SWITCH WITH MAINTAINED CONTACTS FOR GUARD BOOTH # y.
- NOP EFO ARMED YES-NO SELECTOR SWITCH WITH MAINTAINED CONTACTS FOR OVERWATCH POSITION.
- PB-DN-Bx PUSHBUTTON TO LOWER (DOWN) BARRIER # X ON MASTER CONTROL PANEL [GH] AND IN LOCAL PANEL AT BARRIER [L].
- PB-UP-Bx PUSHBUTTON TO RAISE (UP) BARRIER # X ON MASTER CONTROL PANEL [GH] AND IN LOCAL PANEL AT BARRIER [L].
- T1Bx TIMING RELAY WITH 1 SECOND DELAY TO CONTRL RED/GREEN CYCLE ON THE TRAFFIC SIGNAL AT THE BARRIER.
- T2Bx TIMING RELAY WHOSE NO CONTACTS CLOSE AND NC CONTACTS OPEN 15 SECONDS AFTER A CONTINUOUS CALL ON THE QUEUE LOOP (L4). CONTACTS REVERT BACK TO NORMAL POSITION WHEN THE CALL ON L4 DROPS. T2 MARKS THE DURATION OF THE QUEUE PERIOD.
- T3Bx TIMING RELAY SET AT 3 SECONDS TO CONTROL YELLOW CYCLE ON THE TRAFFIC SIGNAL AT THE BARRIER AT THE END OF QUEUE MODE.
- T4Bx TIMING RELAY SET AT 5 SECONDS TO CONTROL BARRIER SUPPRESSION UPON EFO ACTIVATION DURING QUEUE MODE.
- T5Bx TIMING RELAY SET AT 3 SECONDS TO CONTROL YELLOW CYCLE OF THE TRAFFIC SIGNAL UPON ACTIVATION OF EFO DURING QUEUE MODE.
- T6Bx TIMING RELAY SET AT 0.5 SECONDS TO CONTROL FLASHING YELLOW CYCLE OF THE TRAFFIC SIGNAL DURING QUEUE MODE.
- T7Bx TIMING RELAY SET AT 0.5 SECONDS TO CONTROL FLASHING TELLOW CYCLE OF THE TRAFFIC SIGNAL DURING QUEUE MODE.
- TS1-GREEN GREEN LIGHT ACTUATOR FOR THE TRAFFIC SIGNAL AT BARRIER #1.
- TS1-YELLOW YELLOW LIGHT ACTUATOR FOR THE TRAFFIC SIGNAL AT BARRIER #1.
- TS1-RED RED LIGHT ACTUATOR FOR THE TRAFFIC SIGNAL AT BARRIER #1.

NOTES:

1. THIS DRAWING SHOWS REPRESENTATIVE LADDER DIAGRAMS INDICATING THE REQUIRED FUNCTIONS OF THE BARRIER AND TRAFFIC SIGNAL CONTROLS USING THE CONTROL SWITCHES SHOWN ON SHEET E1.03. THE CONTRACTOR'S ACTUAL LADDER LOGIC MUST INCLUDE ALL OF THE CONTROL FUNCTIONS SHOWN HERE AND DESCRIBED IN APPENDIX A (PRESENCE DETECTION SAFETY SYSTEM) OF UFGS 34 21 26.00 10.
2. SEE NOTE 3 ON DWG E1.04 FOR LOOP SAFETY REQUIREMENT.
3. SEE APPENDIX G FOR DESCRIPTION OF CONTROLS.

DEVICE LOCATION SYMBOLS

- [GH] - GATEHOUSE MASTER CONTROL PANEL
- [GBy] - GUARD BOOTH CONTROL PANEL - "y" DENOTES GUARD BOOTH NUMBER
- [OP] - OVERWATCH POSITION CONTROL PANEL
- [L] - LOCAL CONTROL PANEL AT BARRIER



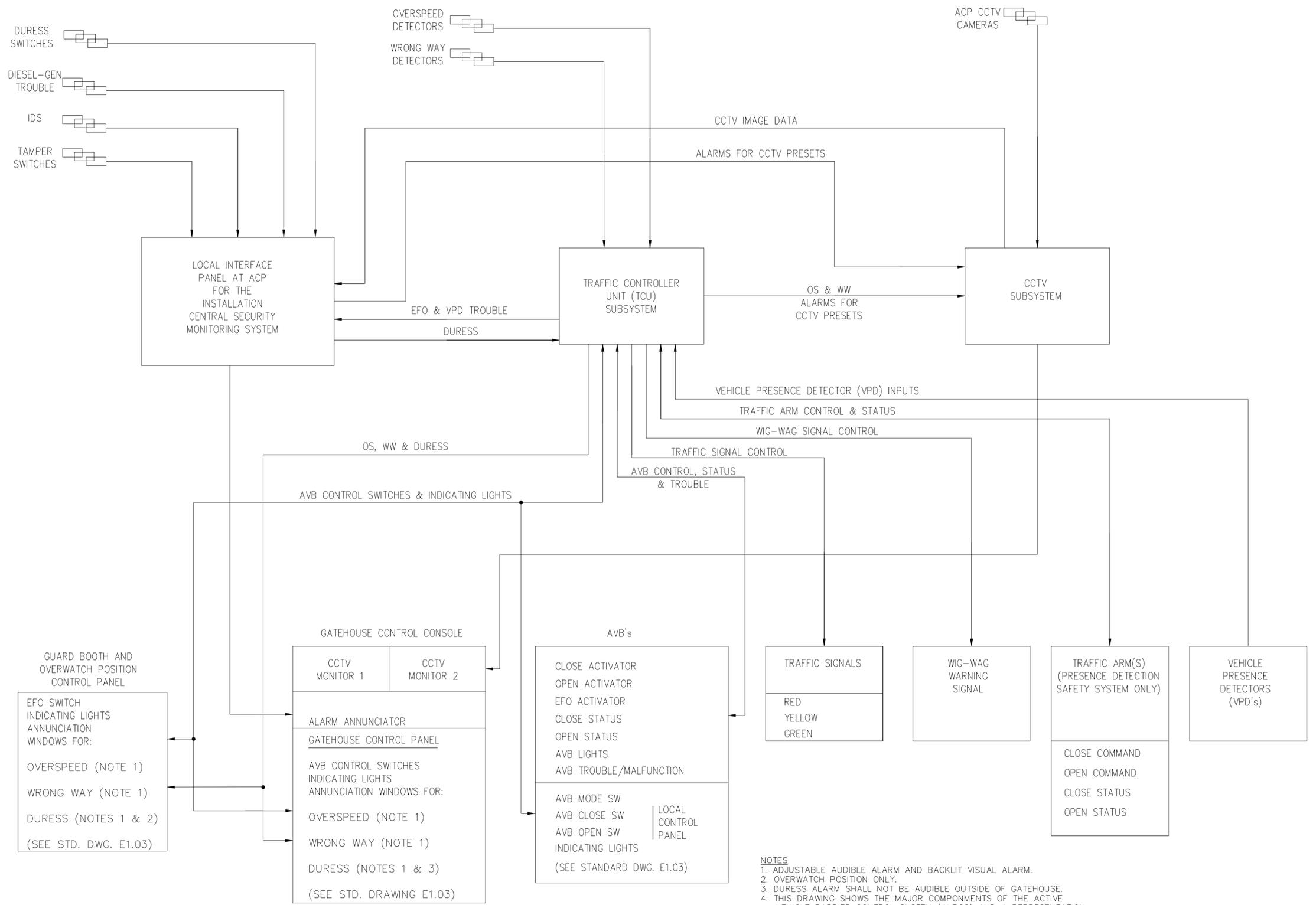
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U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT									

FACILITIES STANDARDIZATION PROGRAM
ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS
CONTROL LOGIC FOR
PRESENCE DETECTION SAFETY SYSTEM WITH
QUEUE CLEARANCE

SHEET
REFERENCE
NUMBER
E1.06
SHEET 58 OF 60

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A



NOTES
 1. ADJUSTABLE AUDIBLE ALARM AND BACKLIT VISUAL ALARM.
 2. OVERWATCH POSITION ONLY.
 3. DUESS ALARM SHALL NOT BE AUDIBLE OUTSIDE OF GATEHOUSE.
 4. THIS DRAWING SHOWS THE MAJOR COMPONENTS OF THE ACTIVE VEHICLE BARRIER CONTROL SYSTEM (AVBCS) AND A REPRESENTATION OF THE COMMUNICATIONS LINKS BETWEEN COMPONENTS. THE DESIGNER SHALL COORDINATE WITH THE INSTALLATION AND THE INSTALLATION'S CENTRAL SECURITY MONITORING SYSTEM (CSMS) CONTRACTOR TO DETERMINE THE INTERFACE REQUIREMENTS BETWEEN THE AVBCS AND THE CSMS. THE DESIGNER SHALL THEN EDIT THIS DRAWING TO REFLECT THE REQUIRED COMMUNICATIONS LINKS AMONG THE VARIOUS AVBCS COMPONENTS AND THE CSMS.

<p>US ARMY CORPS OF ENGINEERS OMAHA DISTRICT</p>	
DESIGNED BY: X.X.X.X	DATE: NOV 2007
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SUBMITTED BY: X.X.X.X	CONTRACT NO.: X
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SIZE: ANSI D	PLOT SCALE: 1:1
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<p>U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA DISTRICT</p>	
<p>FACILITIES STANDARDIZATION PROGRAM ACCESS CONTROL POINTS FOR U.S. ARMY INSTALLATIONS ACTIVE VEHICLE BARRIER CONTROL SYSTEM (AVBCS) CONFIGURATION</p>	
<p>SHEET REFERENCE NUMBER E1.08 SHEET 60 OF 60</p>	

\$\$\$CONSERVE\$\$\$
 \$\$\$SYSTEM\$\$\$
 \$\$\$USERNAME\$\$\$

APPENDIX D

DESIGN PROCEDURE

Appendix D
Design Procedure

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A. General.

1. Designers shall use the following design procedure to determine ACP features that can be used to defeat the four Threat Scenarios defined in the Design Criteria (Appendix B). If additional Threat Scenarios are defined in the project specific criteria, designers can use the equations and methodologies in this Design Procedure to help determine appropriate ACP features against these scenarios as well. The designer shall assemble all selected ACP features into a Protective System.
2. The Designer must select ACP features that enable detection of possible threat vehicles and ACP features that delay the threat vehicle for the times described in the Design Criteria. Detection features include vehicle speed detectors, vehicle wrong-way detectors, and vehicle presence detectors along with detection by security guards. Delay features include straight roadways and roadways with speed management features such as chicanes, loops, serpentine, or turns.
3. Based on the opportunities and constraints of the site, the designer must determine appropriate detection and delay features and perform calculations to assure that the selected features provide the delays required for the given Threat Scenarios.
4. The designer must prepare a Design Analysis showing the Protective System including descriptions of selected ACP features, layouts of detection and delay features, and calculations verifying delay times for each threat scenario listed in the Design Criteria (Appendix B). Calculations must verify that a threat vehicle is detected and delayed a sufficient time to allow guards to deploy the final barriers before the threat vehicle reaches them. For each Threat Scenario, the calculation procedure must identify the following:
 - a. Point of detection. This is the point in or before the ACP corridor that the Threat Vehicle is detected.
 - b. The speed of the Threat Vehicle at the point of detection (V_d).
 - c. The time (T) it takes the threat vehicle to reach the barrier starting from the point of detection and traveling at an initial speed of V_d at that point. Note, time T is dependent on the maximum acceleration and deceleration rates of the threat vehicle and the roadway features between the point of detection and the barrier, e.g., straight roadway, curved roadway, passive barriers in the roadway (serpentine), and turns in the roadway.
 - d. Time T must be equal to or greater than the time delay required in the Design Criteria (Appendix B).

B. Criteria.

1. Threat Scenarios: Show calculations to defeat the following Threat Scenarios:
 - a. Threat Scenario #1 – High Speed. In this threat scenario, Threat Vehicle enters the ACP at the highest speed it can attain considering roadway features before and in the ACP corridor. Threat Vehicle disregards any overspeed detection systems if used. The Threat Vehicle's speed is limited only by the acceleration capability of the threat vehicle and the characteristics of the roadway before and in the ACP corridor.
 - b. Threat Scenario #2 – High Speed. This threat scenario applies only when the Protective System includes overspeed detection. In this threat scenario, the Threat Vehicle enters the ACP at a speed that it is just under the setting of one or more of the overspeed detectors in order to avoid detection. Immediately after passing the range(s) of the overspeed detector(s), the Threat Vehicle begins to accelerate. After passing the range(s) of the overspeed detector(s), the Threat Vehicle's speed will be limited only by the acceleration capability of the threat vehicle and the characteristics of the roadway in the ACP corridor.
 - c. Threat Scenario #3 – Covert Entry at the ID Check Point. In this threat scenario, the Threat Vehicle attempts to gain entry through the ACP using false credentials. When the guard rejects the false credentials and denies access, the Threat Vehicle bolts from the ID Check Point and accelerates toward the final barriers. The Threat Vehicle's speed will be limited only by the acceleration capability of the threat vehicle and the characteristics of the roadway in the ACP corridor.
 - d. Threat Scenario #4 – Covert Entry at the end of the last Turn-around. In this threat scenario, the Threat Vehicle attempts to gain entry through the ACP by using false credentials. When guards at the ID Check Point or Search Area direct the Threat Vehicle to the ACP rejection lane or when guards at the ID Check Point direct the Threat Vehicle to the Search Area, the Threat Vehicle feigns compliance and starts at a low speed (under the 25 mph ACP speed limit) toward the rejection lane or Search Area. Once at the point of the turn, the Threat Vehicle bolts toward the final barriers instead of making the turn. The Threat Vehicle's speed will be limited only by the acceleration capability of the threat vehicle and the characteristics of the roadway in the ACP corridor.
2. Barrier Safety Systems: One of the following active vehicle barrier safety systems must be incorporated in the ACP design:

- a. Signs and Signals Safety System: This safety system consists of a normally open active barrier in each inbound and outbound lane, vehicle presence detectors (VPDs) on both sides of each barrier, warning signs, a traffic signal for each barrier, and controls. Upon actuation of the barrier Close (deployment) command by ACP guards, actual barrier deployment is delayed for 4 seconds while traffic signals at the barrier go through a predefined sequence to warn innocent vehicles who may be approaching the barrier. Also, barrier deployment is suppressed when a vehicle is detected by either VPD.
- b. Presence Detection Safety System: This safety system consists of a normally open active barrier in each inbound and outbound lane, VPDs immediately before and after each barrier, warning signs, a traffic signal for each inbound and outbound barrier, a Stop line in front of each barrier, VPDs in front of each Stop line, and controls. Each barrier's traffic signal is normally Red, which will require an innocent vehicle to stop at the Stop Line. The VPDs in front of the Stop Line will sense the vehicle. If there has not been an active barrier deployment command by ACP guards, the Traffic Signal will change to Green, allowing the vehicle to pass. If there has been a barrier deployment command, the traffic signal will stay Red, holding the vehicle at the Stop Line. If there are no vehicles detected by the VPDs immediately in front of and behind the barrier when a deployment command is initiated by guards, the barrier will immediately close (deploy). If either of the VPDs immediately before or after the barrier detects a vehicle when the barrier deployment command is initiated by guards, barrier deployment will be suppressed until the vehicle clears both of these VPDs. There is no time delay required for safety warning signals for this safety system.
- c. Barrier Normally Closed Safety System: This safety system consists of normally closed active barriers, (VPDs) on both sides of each barrier, warning signs, a traffic signal for each barrier, and controls. In this safety system, two active barriers are arranged to form an entrapment area in each inbound and outbound lane. Barrier controls prevent both barriers in a lane to be open at the same time. Guards ensure that only cleared vehicles are allowed into the entrapment area before closing the initial entrapment barrier and opening the final entrapment barrier. Upon actuation of a barrier Close (deployment) command by ACP guards, actual barrier deployment is delayed for 4 seconds while traffic signals at the barrier go through a predefined sequence to warn innocent vehicles in front of the barrier. Also, barrier deployment is suppressed when a vehicle is detected by either of its VPDs. Since there is always at least one closed barrier in the entrapment area, there is no need to

delay the Threat Vehicle. Calculations to defeat the Threat Scenarios are not required for this safety system.

3. Delay Times:

a. Per OPMG Criteria (Appendix B), the following delay times must be considered for the Signs and Signals Safety System and the Presence Detection Safety System:

- i. Guard Reaction Time: Guard reaction time per the OPMG Criteria (Appendix B) is 3 seconds for Threat Scenarios 1, 2, and 3 and 1 second for Threat Scenario #4.
- ii. Warning Signal Sequence Time: Warning signals sequence time is 4 seconds for the Signs and Signals Safety System and 0 seconds for the Presence Detection Safety System.
- iii. Barrier Deployment Time. Per the OPMG Criteria (Appendix B), active barriers utilized in the normally open mode (Signs and Signals Safety System and Presence Detection Safety System) must have an Emergency Fast Operate (EFO) mode that provides complete barrier closure (deployment) in less than 2 seconds from the time the barrier close control is energized.

b. Total Delay Times: The following total delay times will be used in the calculations to defeat the required Threat Scenarios:

- i. Signs and Signals Safety System:
 1. Nine (9) seconds for Threat Scenarios 1, 2, and 3.
 2. Seven (7) seconds for Threat Scenario 4.
- ii. Presence Detection Safety System:
 1. Five (5) seconds for Threat Scenarios 1, 2, and 3.
 2. Three (3) seconds for Threat Scenario 4.

C. Protective System: The Protective System for the ACP must consist of features that detect the Threat Vehicle and features that delay the Threat Vehicle.

1. Detection Features. The Threat Vehicle can be detected by guards at the ID Check Point, wrong-way detectors located in outbound lanes, and overspeed detectors located at some distance in front of the ID Check Point.

a. Guards.

- i. Threat Scenario #1. In the absence of advanced overspeed detection, the ID Check Point guard is the means of Threat Vehicle detection. In the worst case, the ID Check Point guard will detect the Threat Vehicle, but not until it speeds by the ID Check Point.

- ii. Threat Scenario #2. In this threat scenario, the Threat Vehicle stays under the setting(s) of the overspeed detector(s) so as not to be detected by them. Guards will detect the Threat Vehicle as it passes by the ID Check Point.
 - iii. Threat Scenario #3. Guards detect the Threat Vehicle when it bolts out of the ID Check Point.
 - iv. Threat Scenario #4. Guards detect the Threat Vehicle at the last turn-around when it bolts toward the AVB instead of making the turn to the exit or search lanes.
 - b. Wrong-way Detectors. Wrong-way detectors are located in the outbound lanes to detect a Threat Vehicle attempting to enter the ACP in the outbound lanes.
 - c. Overspeed Detectors. There are two types of overspeed detectors that can be utilized at an ACP.
 - i. Point Overspeed Detection. A point overspeed detector will detect the speed of a vehicle at a particular point on the roadway. Typical point overspeed sensors are paired magnetic loops embedded in the roadway, radar and lidar sensors applied across (transverse to) the roadway, and video motion sensors. Point overspeed detectors located at an ACP measure the speed of vehicles as they cross a point in the roadway, which is a specified distance from the ID Check Point.
 - ii. Continuous Overspeed Detection. A continuous overspeed detector will detect vehicle speed over a range of the roadway. Typical continuous overspeed sensors are Doppler radar sensors looking up (parallel to) the roadway and video motion sensors. Continuous overspeed detectors located at an ACP measure the speed of vehicles in a range starting at a point that is some distance in front of the ID Check Point and ending at a point either at the ID Check Point or a shorter distance in front of the ID Check Point than the starting point. The range of continuous overspeed detectors should usually be no more than 400 feet.
- 2. Delay Features. The ACP must include features that will delay the Threat Vehicle a sufficient time to allow guards to deploy the Active Vehicle Barrier (AVB). Delay features include straight roadways and roadways with speed management features, e.g., curves, turns, chicanes, loops, or serpentine barriers that require all vehicles including the Threat Vehicle to slow down. A Threat Vehicle driving through such a speed management feature faster than the feature's spin-out speed will spin out and thus lose time in its race to the AVB before it deploys.
- 3. Examples. The following sections provide procedures and examples for calculating delay times for ACPs with various detection and delay features. All examples are on Excel Spreadsheets. These spreadsheets can be used by the designer to input alternative parameters and fine tune a design. However, care

should be used in selecting parameters to ensure results are consistent with the assumptions made in developing the spreadsheets. Results should always be verified by hand calculations. If results are suspect, contact the USACE Protective Design Center (PDC) for verification of method and assumptions. Procedures and examples in the paragraphs below are divided into the following roadway types:

- a. Straight Roadways,
- b. Roadways with a Curve or Turn,
- c. Roadways with a Chicane or Loop, and
- d. Roadways with Serpentine Barriers.

D. Straight Roadway.

1. General:

- a. For ACPs with a straight roadway, the Protective System will usually require advanced overspeed detection to detect the Threat Vehicle early in its attack. The distance between the ID Check Point and AVB (Dib) required to delay the Threat Vehicle is a function of the settings of the overspeed detectors. The higher the settings of the overspeed detectors are, the longer the distance Dib must be. Overspeed detectors must be set at speeds that are high enough to avoid excessive nuisance alarms. Therefore, maximizing the distance Dib, whether for a new ACP or upgrading an existing ACP, is a primary design objective.
- b. Distance Dib must be selected to defeat all four Threat Scenarios. In most cases, the worst case (longest) Dib will be the one required to contain high speed Threat Scenarios #1 or #2. Paragraphs 3 and 4 below describe calculation methods for defeating the high speed threats. Paragraph 5 below describes calculation methods for the covert entry threats.

2. ACP Corridor: The following two conditions must be considered when calculating delay for the high speed threat scenarios at an ACP with a straight roadway corridor.

- a. Limited Entry Speed. The first condition is when the speed of the Threat Vehicle entering the ACP corridor is limited by a speed management feature such as a curve, turn, or other permanent roadway feature for which the Threat Vehicle must slow down. The Threat Vehicle's speed in the speed management feature must not exceed the spin-out speed of the feature or else it will spin out and lose the race to the AVB.
- b. Unlimited Entry Speed. The second condition is when the speed of the Threat Vehicle entering the ACP corridor is unlimited by any roadway features outside of the ACP corridor. For this type of ACP, the Threat Vehicle can attain an extremely high speed. Its speed approaching the ACP will be limited

only by restrictions in the ID Check Point area. The ID Check Point's raised islands provide sufficient restrictions to limit the Threat Vehicle's speed to 100 mph as it goes through the ID Check Point. Similar restrictions may be required in the outbound lanes for a Threat Vehicle attempting to enter the Installation through the outbound lanes. For protective systems requiring a maximum speed of 100 mph in the outbound lanes adjacent to the ID Check Point, install raised islands between adjacent lanes that are a minimum of 6" high with vertical curb faces similar to the traffic islands in the ID Check area.

3. High Speed Attack - Limited Entry Speed.

- a. No Advanced Overspeed Detection. Note, without advanced overspeed detection, there is no Threat Scenario #2. See examples at Attachment 2 for the Signs and Signals Safety System and Attachment 8 for the Presence Detection Safety System. Without advanced overspeed detection, the Threat Vehicle is not detected until it passes the ID Check Point (worst case), where it is traveling at a high rate of speed.
 - i. Determine the spin-out speed V_s of the speed management feature near the ACP entrance. See Section E below for the method to calculate the spin-out speed of a speed management feature.
 - ii. Determine the distance D_{si} between the end of the speed management feature and the ID Check Point.
 - iii. Assuming the Threat Vehicle uses Threat Scenario #1 to attack, determine the Threat Vehicle's speed V_i at the point of detection (ID Check Point). This speed is a function of V_s , D_{si} , and the acceleration rate of the Threat Vehicle. Note, this speed cannot be greater than 100 mph because of restrictions in the ID Check area (see paragraph D2b above).
 - iv. Calculate the distance D_{ib} that the Threat Vehicle can travel in the required delay time from the point of detection (ID Check Point) at an initial speed of V_i and accelerating toward the AVB.
 - v. Locate the AVB at a distance D_{ib} or greater beyond the ID Check Point to defeat Threat Scenario #1.
- b. Advanced Overspeed Detection. Without advanced overspeed detection, the required distance D_{ib} between the ID Check Point and the barrier is very large (up to 1778 feet for the Signs and Signal Safety System). Most ACP corridors are not long enough to place the AVB this far from the ID Check Point. Distance D_{ib} is a function of the point where the Threat Vehicle is detected (ID Check Point in the example above) and the Threat Vehicle's speed at the point of detection. In order to reduce the required distance D_{ib} , the Threat Vehicle's speed at the point of detection must be reduced or the point of detection must be moved ahead of the ID Check Point. The following calculation method shows how to select overspeed detection features that have

the effect of either reducing the Threat Vehicle's speed at the point of detection or moving the point of detection ahead of the ID Check Point.

i. One Zone of Continuous Overspeed Detection. Select a continuous overspeed detector to cover a zone in the ACP corridor from the ID Check Point to a certain distance ahead of the ID Check Point. The Threat Vehicle has two options in attacking an ACP with a continuous overspeed detector. The first option is Threat Scenario #1, where the Threat Vehicle ignores the detectors and speeds through the ACP as fast as it can. The second option is Threat Scenario #2, where the Threat Vehicle attempts to stay under the setting of the detector. If the Threat Vehicle exceeds the set point of the detector anywhere within the detector's zone, overspeed alarms notify the guards and the threat vehicle is detected. However, if the Threat Vehicle's speed stays just under the detector setting, the Threat Vehicle will not be detected until it reaches the ID Check Point. At that point, the ID Check Point guards will detect the vehicle and it will be traveling (in the worst case) very close to the overspeed setting of the detector. Therefore, the required distance D_{ib} between the ID Check Point and the AVB is a function of the speed setting of this continuous overspeed detector.

1. Select the desirable or available distance D_{ib} between the ID Check Point and the AVB. Maximize this distance as described below.
2. Using the selected distance D_{ib} between the ID Check Point and the AVB, determine the setting of the continuous overspeed detector required to achieve distance D_{ib} . The setting of the continuous overspeed detector should be set at as high a speed as possible to reduce nuisance alarms. If nuisance alarms are excessive, guards will either ignore the alarms or even turn them off. Without advanced overspeed detection, the ACP will not defeat the high speed threats.
3. In order to maximize the detector's alarm point setting, the distance between the ID Check Point and the AVB (D_{ib}) must be maximized. Where possible, set the distance between the ID Check Point and the AVB at 1118 feet for the Signs and Signals Safety System and 508 feet for the Presence Detection Safety System. These distances require that the continuous overspeed detector be set at 50 mph.
4. For ACPs with limited real estate, the minimum distances between the ID Check Point and the AVB should be 853 feet for the Signs and Signals Safety System and 361 feet for the Presence Detection Safety System. These distances require that the continuous overspeed detectors be set at 30 mph. For ACPs where these minimum distances cannot be achieved, contact the PDC for guidance.

5. For ACPs with available distances D_{ib} between 853 feet and 986 feet, install a second set of continuous overspeed detectors as described in paragraph ii below to help reduce nuisance alarms.
 6. Calculate the range of the continuous overspeed detector. See examples at Attachment 3 for the Signs and Signals Safety System and Attachment 9 for the Presence Detection Safety System. Assume the Threat Vehicle begins its attack in Threat Scenario #1 at the end of the speed management feature traveling at the speed management feature's spin-out speed and is accelerating. Determine the point where the Threat Vehicle must be detected in order to delay it for the required delay time before reaching the AVB. This point is the beginning of the zone of the continuous overspeed detector.
 7. If the range of the overspeed detector calculated above is beyond the range of available detectors or will cause excessive nuisance alarms, add a point overspeed detector or an additional continuous overspeed zone at the point determined above and recalculate the overspeed detector range.
- ii. Two Zones of Continuous Overspeed Detection. If a second zone of continuous overspeed detection is required, see examples at Attachment 4 for the Signs and Signals Safety System and Attachment 10 for the Presence Detection Safety System for the calculation method. Adding a second zone of continuous overspeed detection shrinks the required range of the overspeed zone closest to the ID Check Point (Zone 2), where innocent vehicles must be slowing down anyway to have their ID's checked.
1. Set the zone closest to the ID Check Point (Zone 2) at the speed required to achieve the selected D_{ib}.
 2. Set the zone furthest from the ID Check Point (Zone 1) at 15 mph over the setting of the closer zone (Zone 2). This setting will provide a range of 198 feet for Zone 2.
 3. Calculate the range of the outer continuous overspeed zone (Zone 1) using Threat Scenario #1 and the method described in paragraph D3bi6 above.
 4. If the range of the Zone 1 overspeed detector calculated above is beyond the range of available detectors or will cause excessive nuisance alarms, add a point overspeed detector at the point determined above and recalculate the Zone 1 overspeed detector range.
- iii. Overspeed Zones. Whenever speed zones are used in the ACP's protective system, post speed limit signs at 15 mph at least 250 feet in front of the ID Check Point. Education of ACP users and diligent speed

enforcement by the Installation will be necessary to minimize nuisance overspeed alarms.

4. High Speed Attack - Unlimited Entry Speed ACP.

a. No Advanced Overspeed Detection. See examples at Attachments 5 for the Signs and Signals Safety System and 11 for the Presence Detection Safety System. Note, without overspeed detection, there is no Threat Scenario #2.

- i. The practical maximum speed of the Threat Vehicle at the point of detection (ID Check Point) is $V_{max}=100$ mph.
- ii. Calculate the distance D_{ib} that the Threat Vehicle can travel in the required delay time at an initial speed of V_{max} and accelerating toward the AVB. For $V_{max}=100$ mph, this distance is 1778 feet for the Signs and Signals Safety system and 875 feet for the Presence Detection Safety System.
- iii. Locate the AVB a distance D_{ib} or greater beyond the ID Check Point to defeat Threat Scenario #1.

b. Advanced Overspeed Detection.

- i. One Zone of Continuous Overspeed Detection. See examples at Attachment 6 for the Signs and Signals Safety System and Attachment 12 for the Presence Detection Safety System.
 1. Select the desirable or available distance D_{ib} between the ID Check Point and the AVB. Maximize this distance as described above for the case of the limited entry speed ACP.
 2. Using Threat Scenario #2, determine the setting of the continuous overspeed detector required to achieve the D_{ib} selected above.
 3. Using Threat Scenario #1, calculate the time T_{ib} for the Threat Vehicle to travel distance D_{ib} at an initial speed of $V_{max}=100$ mph.
 4. Subtract T_{ib} from the required delay time to determine the remaining time the Threat Vehicle must be delayed. This time is designated T_{di} and is the time the Threat Vehicle must take to go from the point of detection to the ID Check Point, which is designated as distance D_{di} .
 5. The least time that the Threat Vehicle can go distance D_{di} is by starting at the point of detection at a high initial speed and decelerating at the Threat Vehicle's maximum deceleration rate to V_{max} by the time it gets to the ID Check Point. Calculate D_{di} as a function of V_{max} , T_{di} , and the maximum deceleration rate of the Threat Vehicle.
 6. Locate a point overspeed detector at distance D_{di} in front of the ID Check Point.
 7. Calculate the range of the continuous overspeed detector by assuming the Threat Vehicle will pass the point overspeed detector at just under its setting and then begin to accelerate. The point of detection will then be the beginning of the range of the continuous overspeed detector.

8. If the range of the overspeed detector calculated above is beyond the range of available detectors or will cause excessive nuisance alarms, add a point overspeed detector or an additional continuous overspeed zone at the point determined above and recalculate the overspeed detector range.
 - ii. Two Zones of Continuous Overspeed Detection. If a second zone of continuous overspeed detection is required, see examples at Attachment 7 for the Signs and Signals Safety System and Attachment 13 for the Presence Detection Safety System for the calculation method. Adding a second zone of continuous overspeed detection shrinks the required range of the overspeed zone closest to the ID Check Point (Zone 2), where innocent vehicles must be slowing down anyway to have their ID's checked.
 1. Set the zone closest to the ID Check Point (Zone 2) at the speed required to achieve the selected Dib.
 2. Set the zone furthest from the ID Check Point (Zone 1) at 15 mph over the setting of the closer zone (Zone 2). This setting will provide a range of 198 feet for Zone 2.
 3. Calculate the range of the outer continuous overspeed zone (Zone 1) using Threat Scenario #1 and the method described in paragraph D4bi7 above.
 4. If the range of the Zone 1 overspeed detector calculated above is beyond the range of available detectors or will cause excessive nuisance alarms, add a point overspeed detector at the point determined above and recalculate the Zone 1 overspeed detector range.
 - iii. Overspeed Zones. Whenever speed zones are used in the ACP's protective system, post speed limit signs at 15 mph at least 250 feet in front of the ID Check Point. Education of ACP users and diligent speed enforcement by the Installation will be necessary to minimize nuisance overspeed alarms.
5. Covert Entry Attack.
- a. Threat Scenario #3. Threat Scenario #3 begins at the ID Check Point with the Threat Vehicle stopped. The Threat Vehicle's speed at the point of detection is then $V_d=0$ mph. Threat Scenarios #1 or #2 are always a worse case than Threat Scenario #3.
 - b. Threat Scenario #4. Threat Scenario #4 begins at the end of the last turn-around with the Threat Vehicle traveling at the ACP speed limit. The Threat Vehicle's speed at the point of detection is then $V_d=25$ mph. Threat Scenario #4 may be a worse case than Threat Scenario's #1 and #2, especially if the last turn-around is far from the ID Check Point.

- i. Determine the distance D_{tb} the Threat Vehicle can travel from the point of detection in the required time delay (7 seconds for Signs and Signals Safety System and 3 seconds for the Presence Detection Safety System) assuming it reaches the end of the last turn-around at a speed of 25 mph and begins to accelerate.
 - ii. Add the distance D_{it} from the ID Check Point to the end of the last turn-around to distance D_{tb} calculated above to find distance D_{ib} .
 - iii. Compare distance D_{ib} calculated above to the D_{ib} selected for the high speed threat scenarios. If the D_{ib} calculated for Threat Scenario #4 is greater, move the last turn-around closer to the ID Check Point if possible. If not possible, use the D_{ib} calculated for Threat Scenario #4 and adjust as necessary the settings and locations of any overspeed detectors required for the high speed threats.
6. Summary for ACPs with Straight Roadway Corridors.
 - a. Although speed zones reduce the required length of the Response Zone, they add a level of complexity to the protective system for both guard force operations and equipment maintenance. They should be utilized only when real estate for the ACP is limited and speed management features are not possible. If speed zones are to be utilized, care must be taken when selecting an over-speed detection system. Select system components including sensors, software, and head end equipment that have been proven for similar applications.
 - b. Where possible, maximize the distance between the ID Check Point and the barrier. The locations and settings of the overspeed detectors are a function of this distance. The larger this distance is, the higher the settings of the sensors can be. Higher sensor settings will result in fewer nuisance overspeed alarms, which will improve the efficiency of the guards in identifying potential Threat Vehicles.
 - c. Table 1 “Signs and Signals” lists the required distances between the ID Check Point and the AVB for various settings of the continuous overspeed detector for the Signs and Signals Safety System. Table 2 “Presence Detection” lists the same information for the Presence Detection Safety System.

E. Speed Management.

1. General. Speed Management features such as curves, chicanes, turns, and serpentine barriers can be utilized to slow down the Threat Vehicle and, therefore, provide required delay times in less distance than straight roadways. Speed management features (SMF) provide delay by forcing vehicles to slow down to the spinout speed of the SMF. If a Threat Vehicle exceeds this speed, it will spin out. Even if it recovers, time lost will cause it to lose the race to the

final barrier. The Response Zone is the most effective location for an SMF, as an SMF here will delay the Threat Vehicle in all of the Threat Scenarios.

2. SMF Selection. To select an appropriate SMF, the first step is to evaluate its effect on defeating the given Threat Scenarios. The following is an evaluation of the four Threat Scenarios given in the Design Criteria considering an SMF is deployed in the Response Zone:

a. High Speed Threat Scenario #1. In high speed Threat Scenario #1, the Threat Vehicle speeds through the ID Check Area at the maximum speed it can attain. However, in order to keep from spinning out when it reaches the SMF, it must decelerate at some point before the SMF entrance so its speed when it reaches the SMF is at or below the SMF's spinout speed. If the SMF is selected carefully, advance overspeed detection is not necessary. Select an SMF based on the following and considering that the point of detection is the ID Check Point, i.e., there is no advanced overspeed detection:

- i. Determine the quickest path through the SMF.
- ii. Determine the spinout speed or speeds if there is more than one SMF.
- iii. Determine the time a threat vehicle will take in getting through the SMF considering the path through the SMF and the SMF spinout speed.
- iv. Using the spinout speed at the SMF entrance, the distance between the SMF entrance and the ID Check Point, and the threat vehicle's deceleration rate; determine the time it takes the threat vehicle to go from the ID Check Point to the SMF entrance assuming it is decelerating at its maximum rate over the entire distance.
- v. Subtract the time that the threat vehicle takes to go from the ID Check Point to the SMF entrance plus the time it takes it to go through the SMF from the required delay time to determine if additional delay is required for Threat Scenario #1. If additional delay is required, determine the straight line length of roadway between the end of the SMF and the barrier to get the required delay.

b. Threat Scenario #2. With no advanced overspeed detection, there is no Threat Scenario #2.

c. Threat Scenario #3. Threat Scenario #3 begins and is detected at the ID Check Point. However, the Threat Vehicle's speed when it is detected is zero. The Threat Vehicle in Threat Scenario #1 above is also detected at the ID Check position, but it is traveling much faster. Therefore, Threat Scenario #1 is a worse case than Threat Scenario #3.

d. Threat Scenario #4. Threat Scenario #4 begins and is detected at the end of the last Turn-around. The last turn-around is the turn to the rejection lane or the turn in to the Search Area, whichever is closer to the barrier.

- i. Using the threat vehicle's speed at the end of the last turn around (25 mph), the spinout speed at the SMF entrance, the distance between the SMF entrance and the end of the last Turn-around, and the threat vehicle's acceleration and deceleration rates; determine the time (T_t) that it takes the threat vehicle to go from the end of the last Turn-around to the SMF entrance.
- ii. Add the time T_t to the time it takes the Threat Vehicle to go through the SMF (T_s). Subtract this time from the required delay time to determine if additional delay is required for Threat Scenario #4. If additional delay is required, determine the straight line length of roadway between the end of the SMF and the AVB to get the required delay. Remember, the required time delay for TS#4 is 2 seconds less than for TS #'s 1, 2, and 3 because of the reduced guard reaction time from 3 to 1 second.

F. Curves and Turns: A curve or turn in the Response Zone can be used to slow the threat vehicle and reduce the Response Zone distance required for delay. The threat vehicle in the high speed attack will have to decelerate to the spinout speed of the turn as it enters the turn. Therefore, design the turn and Response Zone such that advanced overspeed detection is not necessary. Without advanced overspeed detection, there is no Threat Scenario #2. The ID Check Point is the point of detection for Threat Scenario #'s 1 and 3 and the end of the last Turn-around is the point of detection for Threat Scenario #4.

1. Design Procedure:

- a. From the Traffic Study, determine the required roadway width and minimum inside radius of the turn.
- b. Select an angle of deflection or Turn angle (CA) for the curve/turn based on the desired delay. Turn angle is the angle between the curve's entrance and exit. The larger the Turn angle, the longer the curve is.
- c. Determine the quickest path through the curve. The quickest path through a curve is a function of the Turn angle, the unobstructed roadway width, and the inside radius of the curve. See Figure 1 below— Path of Threat Vehicle in a Curve/Turn for the calculation method for determining the spinout speed (V_s) of a curve/turn.

- d. Based on the spinout speed (V_s) calculated above, the distance between the ID Check Point (point of detection) and the beginning of the curve (D_{ic}), and the deceleration rate of the threat vehicle (a_d); determine the time the threat vehicle takes to go from the ID Check Point to the beginning of the curve:
 - i. $T_{ic} = (-V_s + (V_s^2 + 2*a_d*D_{ic})^{1/2})/a_d$.
- e. Determine the time to go through the curve:
 - i. $T_c = CA/360*2*pi*R/V_s$, where R is computed from the method shown in Figure 7 – Path of Threat Vehicle in a Curve/Turn.
- f. Calculate the delay time remaining (T_r):
 - i. $T_r = T_d - T_{ic} - T_c$, where T_d is the delay time required for Threat Scenario #1.
- g. Determine the required straight line distance between the end of the turn to the final barrier (D_{cb}):
 - i. $D_{cb} = V_s*T_r + 1/2*a*T_r^2$.
- h. Perform similar procedure for TS#4, only determine the time the Threat Vehicle travels between the end of the last turn around to the beginning of the curve/turn (T_{ec}). $T_{ec} + T_c + T_r$ must be equal to or greater than the required delay time for Threat Scenario #1 (T_d). If $T_{ec} + T_c + T_r$ is greater than T_d , increase T_r by moving the final barrier further away until $T_{ec} + T_c + T_r$ is equal or greater than T_d .

2. Examples:

- a. See Attachment 14 for an example of a curve in the Response Zone utilizing the Signs and Signals Safety System and no advanced overspeed detection.
- b. See Attachment 15 for an example of a curve in the Response Zone utilizing the Signs and Signals Safety System with a point overspeed detector and one zone of continuous overspeed detection.
- c. See Attachment 16 for an example of a curve in the Response Zone utilizing the Presence Detection Safety System and no advanced overspeed detection.
- d. See Attachment 17 for an example of a curve in the Approach Zone utilizing the Signs and Signals Safety System and no advanced overspeed detection.

G. Chicanes and Loops.

1. Parameters of Chicanes and loops. Chicanes and loops are a series of turns whose exit is in the same alignment as its entrance. An example of a loop is shown on Drawing C3.14. Examples of chicanes are shown on Drawings C3.13 and C3.15. In order to determine delay times provided by chicanes and loops, the parameters of the chicane/loop must be defined. Parameters include inside turning radius, unobstructed roadway width, and angle of deflection or turn angle.

- a. Turning radius determines how fast the threat vehicle can turn without spinning out. The spinout speed of a passenger vehicle can be calculated from the following equation (see page 119 of “A Policy on Geometric Design of Highways and Streets 1990” from AASHTO):
- i. Eq. 1) $V_s = ((f+e) * g * R)^{1/2}$, Where:
 1. f=friction factor (assume 0.75 for good tires and dry pavement)
 2. e=super elevation rate (usually between 0.00 and 0.04)
 3. g=acceleration of gravity (32.2 feet/second²)
 4. R=radius of turn in feet.
 - ii. Note, the radius (R) of the turn is not the same radius as the Inside Radius of the curve. The R used to calculate V_s is the radius of the quickest path or path segments through the chicane/loop. The quickest path can have several turns and straight sections. The radius of each turn was computed geometrically and checked graphically to determine each turn’s spinout speed. The various spinout speeds, curve distances, and straight line distances were used to calculate the chicane/loop traverse times.
- b. The unobstructed roadway width is the width of the roadway between curbs. It includes the width of each lane plus the width of any shoulders or gutters. In order to minimize the unobstructed roadway width, roadways through chicanes and loops should be curbed on both sides. For one, two, and three-lane roadways, the unobstructed widths would normally be 14, 26, and 38 feet respectively, that is the 12-foot wide lanes plus one 2-foot gutter.
- c. For a chicane or loop that ends in the same direction and alignment as it started (see Drawings C3.13, 14, and 15), the chicane/loop is a series of four turns; one right turn, two consecutive left turns, and one final right turn or vice versa. The turn angle is the angle that each turn makes between its entrance and exit. The turn angle determines the total distance traveled. The larger the turn angle is, the longer the turn distance is and, therefore, the longer the delay time is. To provide sufficient delay, turn angles normally vary between 50 and 90 degrees. Care must be taken in selecting turn angles. For wide roadway widths, larger turn angles are required to provide required delay, because the threat vehicle will use the wide roadway to switch between lanes and achieve a large radius path or paths through the chicane/loop. Use the following equations to calculate the total travel distance in the chicane/loop and the length and width of the chicane/loop given the inside radius, the turn angle, the roadway width, and the median width.

i. For Chicanes:

1. Eq. 2) CLR (Chicane Centerline Radius) = $IR+W+M/2$
2. Eq. 3) CD (Centerline Distance) = $4*CLR*Theta$
3. Eq. 4) CL (Chicane Length) = $4*CLR*Sin(Theta)$
4. Eq. 5) CW (Chicane Width) = $2*CLR*(1-Cos(Theta))+2*W+M$,

Where:

- a. IR is the inside radius of chicane;
- b. Theta is the turn angle;
- c. W is the roadway width, and
- d. M is the median width.

ii. For Loops:

1. Eq. 2a) CLR (Loop Centerline Radius) = $IR+W/2$
2. Eq. 3a) CD (Centerline Distance) = $4*CLR*Theta$
3. Eq. 4a) CL (Loop Length) = $4*CLR*Sin (Theta)$
4. Eq. 5a) CW (Loop Width) = $2*(2*CLR*(1-Cos (Theta)))+ W)+M$,

Where:

- a. IR is the inside radius of curve;
- b. Theta is the turn angle;
- c. W is the roadway width, and
- d. M is the median width.

2. Time Delay through Chicanes and loops.

- a. The ideal minimum time required to traverse a chicane/loop can be calculated using the chicane/loop centerline distance (Eq. 3 or 3a) divided by the maximum speed in the chicane/loop (Eq. 1). However, the ideal time assumes the threat vehicle will follow the centerline radius through the chicane/loop. In reality, the threat vehicle will use the entire width of the roadway to maximize the turning radii and thus maximize its spinout speeds. The practical traverse time can be calculated by analyzing the chicane/loop and determining the quickest path through it. This path will consist of several segments. Once the segments of the path are determined, calculate the radius, distance, maximum speed, and time to traverse each segment and add these times together to obtain the total traverse time.

- b. The fastest path through a chicane/loop depends on the turn angle, the clear roadway width, and physical features at the entrance and exit. Two different paths were analyzed in this design procedure as follows:
- i. Tangent Method – This path consists of 3 curved sections and 2 straight sections. Considering the chicane/loop consists of 4 Turns as described above, the path through the chicane/loop follows:
 1. Approach Turn #1 from the left most ID Check Lane and gradually turn on a circular path toward the right hand curb of Turn #1. For a 6-foot wide vehicle, the centerline of the vehicle would travel toward a curve with a radius of 3 feet longer than the inside radius of Turn #1. Travel speed is limited by the radius of the curve.
 2. Follow this curve a certain distance through Turn #1 and then turn straight toward the left curb of Turn #2. The straight section is a line tangent to the two circles defined by Turn #1 and Turn #2. These circles are separated by a distance $s = RW - 6$, where RW is the unobstructed roadway width and the 6 feet is the width of the threat vehicle. Travel speed in the straight section is limited by how fast the vehicle can accelerate after exiting the first curve and how fast it must decelerate before entering the second curve.
 3. The vehicle would then follow the left curb of the rest of Turn #2 and part of Turn #3 and then turn straight again toward the right curb of Turn #4.
 4. The vehicle would finally travel along the right curb of Turn #4 and exit along a curve with the maximum radius attainable through the active vehicle barriers at the end of the curve.
 - ii. Three Curve Method – This path consists of three circle segments, one segment entering the Chicane/loop, one segment through the middle section of the Chicane/loop, and one segment exiting the Chicane/Turn. The middle circle segment is tangent to both the entrance and exit circle segments. Travel speeds are limited by the radius of each circle segment.
- c. Chicanes and loops with various inside radii and roadway widths were evaluated to determine the quickest paths through them. Tables 3 and 4 below show parameters of these chicanes and loops respectively. For a given roadway width (number of lanes) and inside roadway radius, the tables show the required turn angle to achieve the 9 or 7 seconds of delay required for the Signs and Signals Safety System. The tables also list the distance through the Chicane/Loop (CD), Chicane/Loop Length (CL), Roadway Corridor Width (CW), Chicane/loop Traverse Time (Trz), and the time to traverse the distance between the ID Check Point and the active barriers (T_{ib}). Times Trz and Tib

listed in the tables are the best (least) traverse times between the two paths described above. Generally, for low turn angles, the Three Curve method is fastest, whereas, for higher turn angles, the Tangent method is fastest. Tables 5 and 6 below show the same information for chicanes and loops using the Presence Detection Safety System.

d. In Tables 3 through 6, the computed chicane and loop parameters assume that the ID Check Point is 90 feet in front of the chicane/loop and that inbound lanes are separated by raised islands. Also, the computed parameters assume that the active vehicle barriers are just beyond the end of the chicane/loop. These assumptions affect the radii of both entrance and exit curves and, therefore, the threat vehicle's entry and exit speeds. If conditions at the entrance or exit to the chicane/loop are different than described above, calculations using the actual conditions must be performed.

3. Design Procedure for a Chicane or Loop:

- a. For a Chicane or Loop deployed in the Response Zone and meeting the requirements listed above, perform the following:
 - i. Step 1 – Consider traffic volumes and types based on the Traffic Engineering Study and select appropriate parameters for the roadway width and the chicane/loop's inside radius.
 - ii. Step 2 - Select the AVB safety system, either Signs and Signals or Presence Detection.
 - iii. Step 3 – Select the appropriate Table 3, 4, 5, or 6 based on the type feature (chicane or loop) and the AVB Safety System (Signs and Signals or Presence Detection).
 - iv. Step 4 - For the appropriate roadway width and roadway inside radius, find the required chicane/loop parameters from the Table.
- b. For chicanes or loops that do not meet the requirements listed above, determine the fastest path through the chicane/loop and perform calculations to determine traverse times, or consult the PDC.

H. Serpentine Barriers:

1. General:

- a. Passive barriers arranged in a serpentine and placed in the Response Zone can be used to slow the threat vehicle and reduce Response Zone distances required for delay. Passive barriers must be substantial enough to stop or at least significantly slow down a vehicle upon impact. Concrete Jersey Barriers

or other equivalent passive barriers are suitable for serpentine application. See Figure 2 for layout.

b. Similar to the case for curves and turns, the threat vehicle in the high speed attack will have to decelerate to the spinout speed of the serpentine as it enters the serpentine. Therefore, design the serpentine and Response Zone such that advanced overspeed detection is not necessary. Without advanced overspeed detection, there is no Threat Scenario #2. The ID Check Point is the point of detection for Threat Scenario #'s 1 and 3. The end of the last turn-around is the point of detection for Threat Scenario #4.

2. Design Procedure:

a. Refer to Figure 3 Serpentine Spinout Speeds to determine the spinout speed (V_s) of the serpentine. Note, the spinout speed is a function of the spacing between passive barriers.

b. Based on the spinout speed (V_s) determined above, the distance between the ID Check Point (point of detection) and the beginning of the serpentine (D_{is}), and the deceleration rate of the threat vehicle (a_d); determine the time the threat vehicle takes to go from the ID Check Point to the beginning of the serpentine:

i. $T_{is} = (-V_s + (V_s^2 + 2*a_d*D_{is})^{1/2})/a_d$.

c. Determine the time to go through the serpentine:

i. $T_s = 2*s/V_s$, Where s =barrier spacing.

ii. Note: the actual distance through the serpentine is slightly larger than $2*s$, but only slightly, so use $2*s$.

d. Calculate the delay time remaining (T_r):

i. $T_r = T_d - T_{is} - T_s$, Where T_d is the delay time required for Threat Scenarios 1 and 3.

e. Determine the required straight line distance between the end of the serpentine and the AVB (D_{sb}).

i. $D_{sb} = V_s * T_r + 1/2 * a * T_r^2$

f. Perform similar procedure for TS#4; only determine the time the Threat Vehicle travels between the end of the last Turn-around to the beginning of the serpentine (T_{es}). $T_{es} + T_s + T_r$ must be equal to or greater than the required delay time for Threat Scenario #4.

3. Example: See Attachments 18 and 19 for examples for computing delay for serpentine in the Response Zone. Note, use of serpentine barriers reduces the effective roadway width. For a typical 2 lane roadway, the serpentine barriers

reduce the roadway to 1 lane. Serpentine barriers should only be used when traffic volumes can be handled by the reduced roadway widths.

I. Vehicle Barrier Sizing:

1. General: Per the OPMG Criteria (Appendix B) there are two types of threat vehicle, the high performance threat vehicle capable of accelerating at 11.3 f/s/s, and the 15,000-pound truck threat vehicle. The high performance threat vehicle is used to determine the barrier location to meet delay requirements. The 15,000-pound threat vehicle is used to determine the required stopping capacity of active and passive vehicle barriers. The stopping capacity of vehicle barriers is measured in kinetic energy. The barrier's stopping capacity must be greater than the threat vehicle's kinetic energy at the point of impact with the barrier. The threat vehicle's kinetic energy at the point of impact with the barrier is determined by the following formula:
 - a. $KE=1/2*M*(V*\sin(\theta))^2$, where
 1. KE=Kinetic Energy,
 2. M=Mass of Threat Vehicle,
 3. V=Velocity of Threat Vehicle, and
 4. θ =Angle of impact between the barrier and the Threat Vehicle.
2. Active Barriers: Per the OPMG Criteria (Appendix B), active vehicle barriers shall be capable of stopping a 15,000-pound vehicle traveling at the maximum speed it can attain before impacting the barrier, but in no case shall the speed be less than 30 mph. The 15,000-pound threat vehicle's speed when it reaches the barrier depends on several factors, including initial speed, maximum acceleration rate(s), distance to barrier, and the alignment and grade of the roadway approaching the barrier. To determine the required vehicle stopping energy of the active vehicle barrier, use the following procedure:
 - a. Determine the distance from the ID Check Point to the barrier (Dib) by evaluating the high speed Threat Vehicle (see Paragraphs D through H above).
 - b. Determine roadway alignment in front of and through the ACP corridor including any speed management features that will limit the Threat Vehicle's speed.
 - c. Determine the grade of the ACP corridor.
 - d. Determine the acceleration characteristics of the Threat Vehicle.

Traditionally, trucks with a gross vehicle weight rating (GVWR) of 15,000 pounds are large single unit (SU) trucks. Acceleration characteristics at various grades for a large SU truck with a GVWR of 12,000-pounds are shown in Figure 4. Acceleration rates for a 15,000 pound SU will be similar.

Recently, heavy duty pick-up trucks are becoming available with GVWR approaching 15,000 lbs. Figure 5 shows the acceleration characteristics at various grades for the Ford F450, which has a GVWR of 14,500 pounds. Note for both vehicles, the acceleration rate is fairly constant up to about 15 mph, but then continually decreases as speed increases. However, the acceleration rates for the F450 are significantly higher than the SU truck.

- e. Calculate the 15,000-pound threat vehicle's velocity and energy at the barrier under each Threat Scenario. Threat vehicle kinetic energy is found from the equation in paragraph 1a above. Note, the impact angle θ is 90° for active barriers deployed in the roadway.
 - f. Select a barrier whose kinetic energy stopping capacity is greater than the highest threat vehicle kinetic energy determine above.
3. Active Barrier Example. Assume the evaluation of the high speed threat vehicle resulted in an ACP with a straight and level corridor, no speed management features, one zone of continuous overspeed detection set at 50 mph, and a $D_{ib}=1118$ feet.
- a. Threat Scenario #1: In Threat Scenario #1, the threat vehicle enters the ACP as fast as it can go considering any speed management features (SMF) or other features in the ACP corridor that would cause it to slow down. In this example, there are no SMFs, however the threat vehicle's speed will be limited by restrictions in the ID Check Point area. For the high speed Threat Vehicle, the maximum speed through the ID Check Point area was limited to 100 mph (see paragraph D2b above). A practical limit for the SU truck would be 40 mph and for the F450 would be 60 mph. Per Figure 4, at an initial speed of 40 mph, a 15,000-pound SU truck will accelerate to about 50 mph after traveling 1118 feet. The threat vehicle's kinetic energy would be 1,253,000 foot-pounds, which would require a K12 rated barrier. Per Figure 5, at an initial speed of 60 mph, the F450 will accelerate to about 70 mph after traveling 1118 feet. The threat vehicle's kinetic energy would be 2,373,000 foot-pounds, which would exceed the capacity of a K12 rated barrier.
 - b. Threat Scenario #2: In Threat Scenario #2, the Threat Vehicle is detected at the ID Check Point when it is traveling at or below a speed equal to the setting of the continuous overspeed detector nearest to the ID Check Point. For this example, the continuous overspeed detector is set at 50 mph, which is higher than the maximum practical speed of the 15,000-pound SU truck at the ID Check Point but lower than the maximum speed of the F450. Therefore, the threat vehicle's speed and energy at the barrier will be less than the speed and energy for Threat Scenario #1 determined above.

- c. Threat Scenario #3: In Threat Scenario #3, the Threat Vehicle is detected at the ID Check Point and is stopped. Per Figure 4, at an initial speed of 0 mph, the 15,000-pound SU truck will accelerate to about 43 mph after traveling 1118 feet. The threat vehicle's kinetic energy would be 926,000 foot-pounds, which is less than that determined for Threat Scenario #1 above. Per Figure 5, the F450 starting at 0 mph and traveling 1118 feet will accelerate to about 57 feet when it reaches the barrier. The F450's kinetic energy will be 1,574,000 foot-pounds, which is less than that determined for Threat Scenario #1 above.
 - d. Threat Scenario #4: In Threat Scenario #4, the Threat Vehicle is detected at the end of the last turn-around, which is 90 feet beyond the ID Check Point and is traveling at 25 mph. Per Figure 4, at an initial speed of 25 mph, the 15,000-pound SU Truck will accelerate to about 43 mph after traveling $(1118 - 90 =)$ 1028 feet. The threat vehicle's kinetic energy would be 926,000 foot-pounds, which is less than that determined for Threat Scenario #1 above. Per Figure 5, at an initial speed of 25 mph, the F450 will accelerate to about 57 mph after traveling $(1118 - 90 =)$ 1028 feet. The threat vehicle's kinetic energy would be 1,574,000 foot-pounds, which is less than that determined for Threat Scenario #1 above.
 - e. Select Threat Scenario #1 as the worst case. Note, the F450's kinetic energy at the barrier of 2,373,000 foot-pounds exceeds the rating of a K12 barrier (1,253,000 foot-pounds). However, at speeds over 50 mph, most K12 rated active vehicle barriers will disable if not destroy a 15,000 pound SU or a F450 type heavy duty pick-up. Therefore, based on engineering judgment, a K12 rated active vehicle barrier would be sufficient to defeat the Threat Vehicle in this example.
4. Passive Barriers: Per the OPMG Criteria (Appendix B), passive barriers are required to stop a 15,000 pound threat vehicle anywhere along the ACP corridor traveling at whatever speed and impact angle it can attain upon barrier impact. The 15,000-pound threat vehicle's energy when it impacts the barrier depends on its speed and impact angle per the equation in paragraph I1 above. To determine the required vehicle stopping energy of passive vehicle barriers, use the following procedure:
- a. Evaluate the entire ACP corridor. Determine each curve, turn, and straight segment in the ACP corridor.
 - b. For each corridor segment, determine the maximum speed and impact angle attainable by the 15,000 pound threat vehicle. Note, corridor segments with curves or turns may allow larger impact angles (which may require higher energy capacity barriers) than straight segments.

- i. The threat vehicle's kinetic energy increases with increasing impact angles and increasing velocities per the equation in paragraph I1 above.
 - ii. The impact angle for the threat vehicle is a function of the vehicle's velocity and the clear roadway width, i.e., the width of the roadway between the passive barriers.
 - iii. Figure 6 shows the relationship between the clear roadway width and the threat vehicle's impact angle for a straight roadway segment. From Figure 6, as the threat vehicle's speed increases, the radius of its turn into the passive barrier must also increase to keep from spinning out. As the threat vehicle's turn radius increases, its impact angle into the barrier decreases. Increasing threat vehicle speed increases kinetic energy, however, because of the resultant decrease in impact angles, speeds above 50 mph result in only small increases in kinetic energy. Table 7 shows the threat vehicle's kinetic energy for various clear roadway widths for a 15,000 pound threat vehicle traveling at 50 mph upon impact.
 - iv. Figure 7 shows the relationship between the clear roadway width and the threat vehicle's impact angle for a roadway segment with a curve.
- c. Determine the maximum threat vehicle speed for each passive barrier segment in the corridor and the resultant impact angles from the method shown in Figure 6 for straight corridor segments and Figure 7 for corridor segments with curves.
 - d. Using the equation in paragraph I1 above, determine the maximum kinetic energy of the threat vehicle for each corridor segment.
 - e. Select a passive barrier with stopping capability equal to or greater than the threat vehicle's kinetic energy for each corridor segment.
5. Passive Barrier Example. Assume the evaluation of the high speed threat vehicle resulted in an ACP with a 50' wide clear roadway width and a right hand 130' radius 90° turn that is 225' beyond the ID Check Point. Using Attachment 14 "Example - Curve in Response Zone, Signs and Signals Safety System", there must be 249' of straight roadway beyond the end of the threat vehicle's path in the turn to the barrier.
 - a. Determine the passive barrier capacity for barriers along the curve and for barriers in the straight roadway sections before and after the curve.
 - b. Barriers along the curve.
 - i. For a turn to the right, the Threat Vehicle can impact the left side passive barrier without having to slow down for the curve. The impact angle is a function of the curve radius and the clear roadway width between the passive barriers – see Figure 7 – Threat Vehicle Impact Angle in a Curve. From Figure 7 with an inside radius of IR=130 feet and a clear roadway

width of RW=50 feet (4 lane roadway), the Threat Vehicle's impact angle is $\theta = 90^\circ - \text{ArcSin}((R - RW + Dpb)/R)$; where $R = IR + RW = 180'$, $RW = 50'$, and $Dpb = 4'$. For this example, $\theta = 41.9^\circ$.

- ii. From Attachment 14, the maximum speed in the curve is 57 mph and the maximum speed at the ID Check Point to keep from spinning out in the curve is 77 mph. The maximum speed of the 14,500 pound F450 through the ID Check Point, per paragraph 13a above, is 60 mph. The distance between the ID Check Point and the point of impact with the left side passive barrier is $225' + R * \text{Sin}(\theta) = 345'$ (see figure 7). The Threat Vehicle will pass the ID Check Point at 60 mph and then start to accelerate through the 345' to the barrier. From Figure 5, the Threat Vehicle's speed at the point of impact with the barrier is about 63 mph. The Threat Vehicle's kinetic energy at the point of impact is $KE = 1/2 * 14,500/32.2 * (63 * 5280/3600 * \text{Sin}(41.9^\circ))^2 = 857,000$ foot-pounds.

c. Barriers along the straight sections.

- i. For straight sections of the roadway, the Threat Vehicle's impact angle with the barrier is a function of the Threat Vehicle's speed and the clear roadway width between the passive barriers along the roadway – see Figure 6.
- ii. Straight Section after the curve. From paragraph 5bii above, the Threat Vehicle's maximum speed through the curve is 57 mph. The active barrier is 249' from the end of the threat vehicle's path in the curve. From Figure 5, the Threat Vehicle can attain a speed of about 60 mph before impacting the active barrier. To attain its maximum speed upon impact, the Threat Vehicle would attempt to impact the passive barrier just ahead of the active barrier. Using the method shown on Figure 6 at a speed of 60 mph, the radius of the Threat Vehicle's turn into the barrier must be no greater than 341' and its impact angle into the barrier can be no greater than $\theta = 30^\circ$. Maximum Threat Vehicle kinetic energy is then

$$KE = 1/2 * 14,500/32.2 * (60 * 5280/3600 * \text{Sin}(30^\circ))^2 = 436,000 \text{ foot-pounds.}$$

- iii. Straight Section before the curve. The Threat Vehicle's maximum speed through the ID Check Point is 60 mph. In order maximize its impact speed, the Threat Vehicle would attempt to impact the straight section of the passive barrier just ahead of the curve. This point is 225' from the ID Check Point. Per Figure 5, the Threat Vehicle's speed at the point of impact would be about 62 mph. Using the method shown on Figure 6 at a speed of 62 mph, the radius of the Threat Vehicle's turn into the barrier must be no greater than 342' and its impact angle into the barrier can be no greater than $\theta = 30^\circ$. Maximum Threat Vehicle kinetic energy is then $KE = 1/2 * 14,500/32.2 * (62 * 5280/3600 * \text{Sin}(30^\circ))^2 = 465,000$ foot-pounds.

d. Conclusion. The required kinetic energy capacity of the passive barriers along the first straight roadway section is 465,000 foot-pounds, which is slightly higher than the stopping capacity required for the straight section after the curve, which is 436,000 foot-pounds. Use passive barriers with a stopping capacity of 465,000 foot-pounds for both straight roadway sections and the right side of the curve section. Use passive barriers with a stopping capacity of 824,000 foot-pounds for the left side of the curve section, which is slightly higher than the 802,000 foot-pound capacity of a K8 rated barrier.

J. Summary: Using properly designed Speed Management Features in the Response Zone can effectively delay the Threat Vehicle in all 4 of the Threat Scenarios defined in the criteria. When SMF's cannot be utilized, large distances in the Response Zones are required to defeat the Threat Scenarios defined in the criteria, especially Threat Scenario #2. Over-speed detection systems can be utilized to reduce Response Zone lengths, but these systems add complexity in ACP operations and equipment maintenance and are not as effective as Speed Management Features.

Signs & Signals	
Detector Setting	Dib
30 mph	854'
35 mph	920'
40 mph	986'
45 mph	1052'
50 mph	1118'

Table 1

Presence Detection	
Detector Setting	Dib
30 mph	361'
35 mph	398'
40 mph	435'
45 mph	471'
50 mph	508'

Table 2

TABLE 3 - CHICANES - SIGNS AND SIGNALS										
Roadway Width (feet)	14	14	14	14	26	26	26	38	38	38
Inside Radius (feet)	50	65	130	205	65	130	205	65	130	205
Curve Angle (Deg)	70	80	50	50	70	60	50	70	60	50
C/L Radius (feet)	76	91	156	231	103	168	243	115	180	255
Distance thru Feature (feet)	371	508	545	806	503	704	848	562	754	890
Length of Feature (feet)	286	358	478	708	387	582	745	432	624	781
Width of Feature (feet)	152	202	163	217	212	244	250	251	280	282
ID Chk Pt to Barrier Traverse Time (sec)	9.3	12	9.3	11.1	9.9	10.8	10.7	9.6	11	11
Feature Traverse Time (sec)	7.7	10	8.1	10.1	8.4	9.6	9.8	8.3	9.5	9.6
Median Width is	24 feet									
ID Check Point to Loop Entrance is	90 feet.									

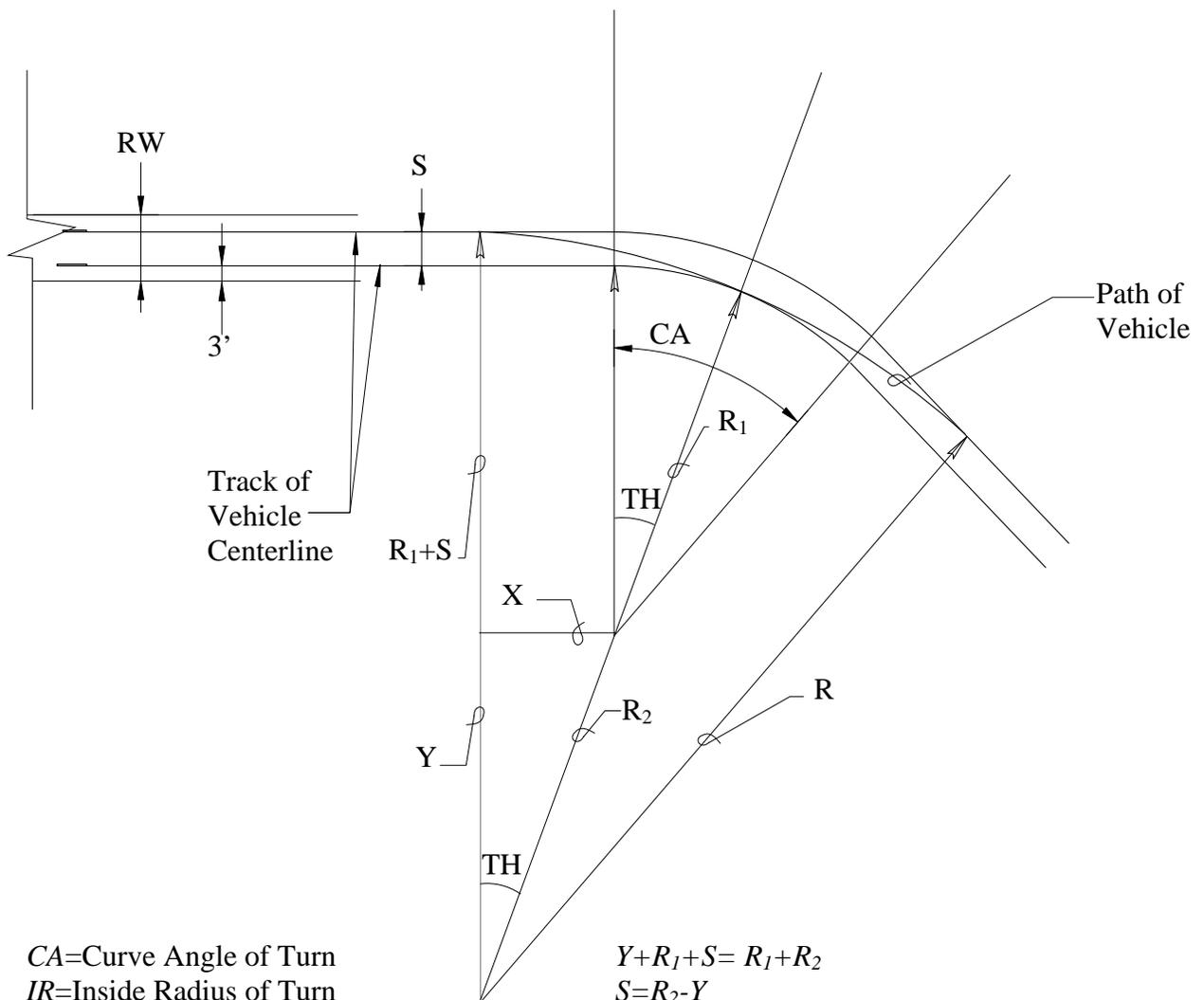
TABLE 4 - LOOPS - SIGNS AND SIGNALS									
Roadway Width (feet)	14	14	14	26	26	26	38	38	38
Inside Radius (feet)	65	130	205	65	130	205	65	130	205
Curve Angle (Deg)	70	60	50	80	60	50	80	60	50
C/L Radius (feet)	72	137	212	78	143	218	84	149	224
Distance thru Feature (feet)	352	574	740	436	599	761	469	624	782
Length of Feature (feet)	271	475	650	307	495	668	331	516	686
Width of Feature (feet)	241	326	355	334	362	387	378	398	420
ID Chk Pt to Barrier Traverse Time (sec)	9.1	10.5	10.7	9.9	10	10.2	9.5	9.5	9.9
Feature Traverse Time (sec)	7.5	9.2	9.6	8.4	8.77	9.2	8.1	8.5	8.9
Median Width is	24 feet								
ID Check Point to Loop Entrance is	90 feet.								

TABLE 5 - CHICANES - PRESENCE DETECTION										
Roadway Width (feet)	14	14	14	14	26	26	26	38	38	38
Inside Radius (feet)	50	65	130	205	65	130	205	65	130	205
Curve Angle (Deg)	40	40	30	30	50	40	30	50	40	30
C/L Radius (feet)	76	91	156	231	103	168	243	115	180	255
Distance thru Feature (feet)	212	254	327	484	360	469	509	401	503	534
Length of Feature (feet)	195	234	312	462	316	432	486	352	463	510
Width of Feature (feet)	88	95	94	114	150	155	141	182	184	168
ID Chk Pt to Barrier Traverse Time (sec)	5.1	5.6	5.5	6.5	6.5	6.8	5.8	6.3	6.3	5.2
Feature Traverse Time (sec)	3.8	4.3	4.3	5.6	5.4	5.7	4.9	5.1	5.3	4.4
Median Width is	24 feet									
ID Check Point to Loop Entrance is	90 feet.									

TABLE 6 - LOOPS - PRESENCE DETECTION									
Roadway Width (feet)	14	14	14	26	26	26	38	38	38
Inside Radius (feet)	65	130	205	65	130	205	65	130	205
Curve Angle (Deg)	40	30	30	50	40	30	60	40	40
C/L Radius (feet)	72	137	212	78	143	218	84	149	224
Distance thru Feature (feet)	201	287	444	272	399	457	352	416	626
Length of Feature (feet)	185	274	424	239	368	436	291	383	576
Width of Feature (feet)	119	125	166	187	210	193	268	239	310
ID Chk Pt to Barrier Traverse Time (sec)	5.2	5.1	6.4	5.7	6.1	5.3	6.6	5.3	7.4
Feature Traverse Time (sec)	3.7	3.9	5.4	4.3	5	4.5	5.3	4.4	6.4
Median Width is	24 feet								
ID Check Point to Loop Entrance is	90 feet.								

TABLE 7 - THREAT VEHICLE KINETIC ENERGY VS. ROADWAY WIDTH

Number of Lanes	Clear Width (feet)	Threat Vehicle Speed (mph)	Attack Angle (degrees)	Impact Energy (Ft-Lbs)
1	15	50	18.1	120,694
2	27	50	26.3	245,387
3	39	50	32.6	362,806
4	51	50	37.9	472,950
5	63	50	42.7	575,819
6	75	50	47.1	671,413



CA =Curve Angle of Turn
 IR =Inside Radius of Turn
 RW =Width of Unobstructed Roadway
 R =Radius of Path of Threat Vehicle
 $R_1=IR+3$
 $S=RW-6$
 $TH=\frac{CA}{6}$
 $COS(TH)=\frac{Y}{R_2}$
 $Y=R_2 \cdot COS(TH)$
 $R=Y+R_1+S$
 $R=R_1+R_2$

$Y+R_1+S=R_1+R_2$
 $S=R_2-Y$
 $S=R_2-R_2 \cdot COS(TH)$
 $R_2=\frac{S}{1-COS(TH)}$
 $R=R_1+\frac{S}{1-COS(TH)}$
 $V_s=\sqrt{R \cdot g \cdot (f+e)}$
 $X=\frac{S \cdot SIN(TH)}{1-COS(TH)}$

Figure 1
Path of Threat Vehicle in a Curve/Turn

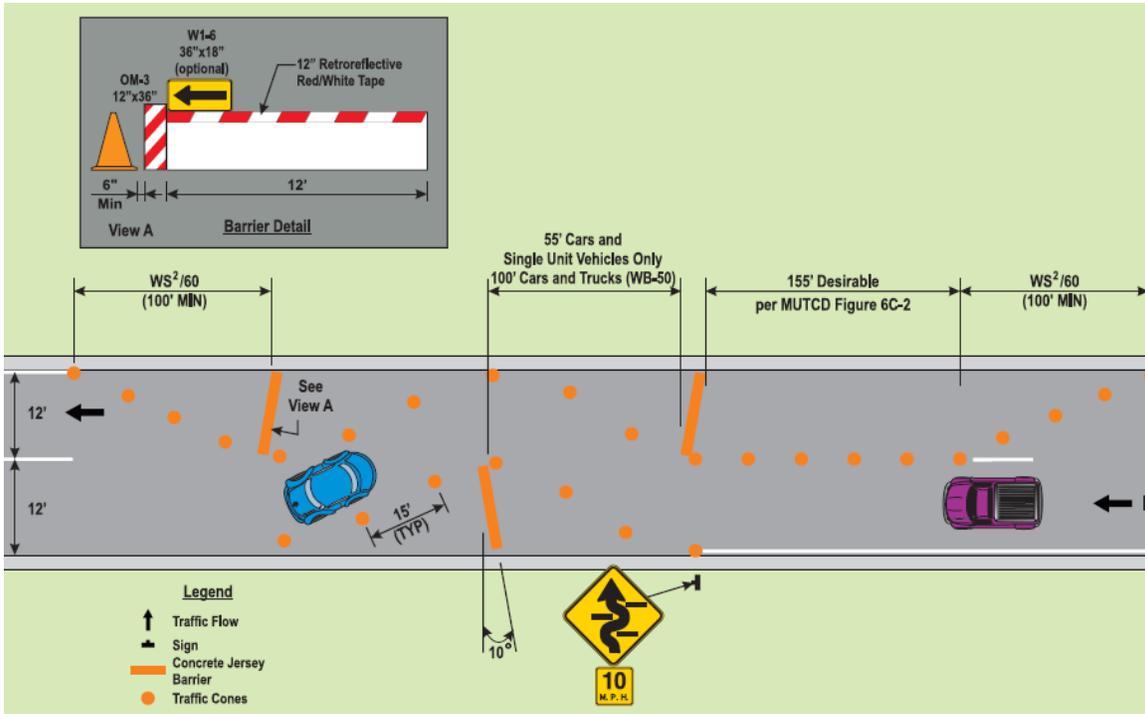


Figure 2 – Serpentine Barriers Layout

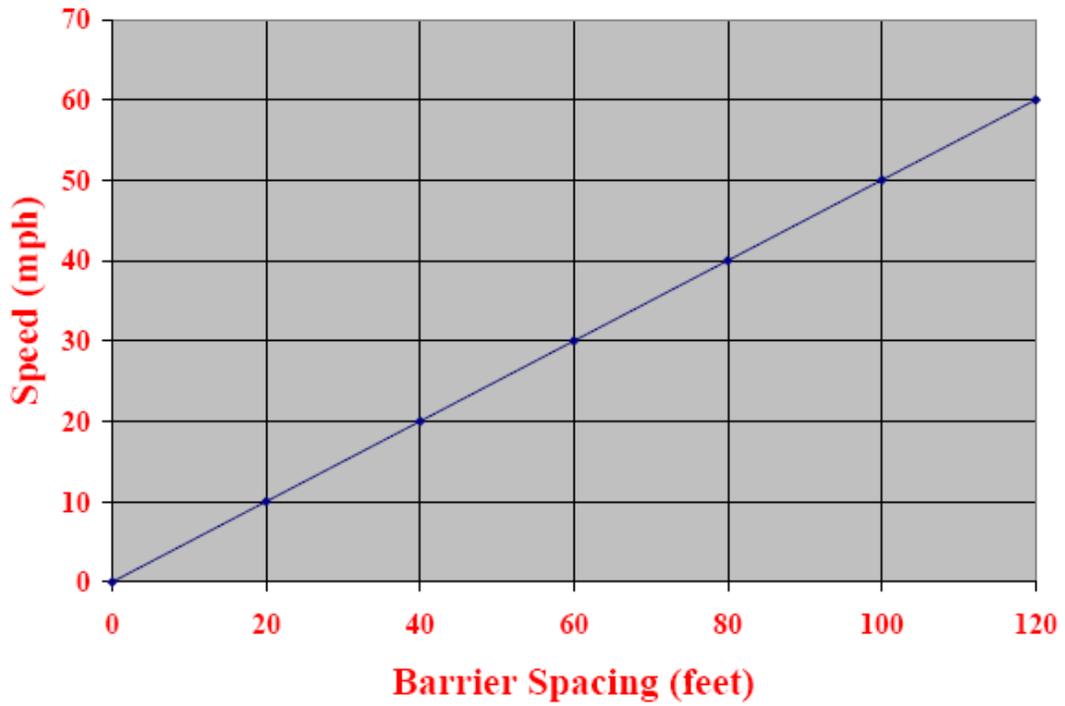


Figure 3 – Serpentine Spinout Speeds

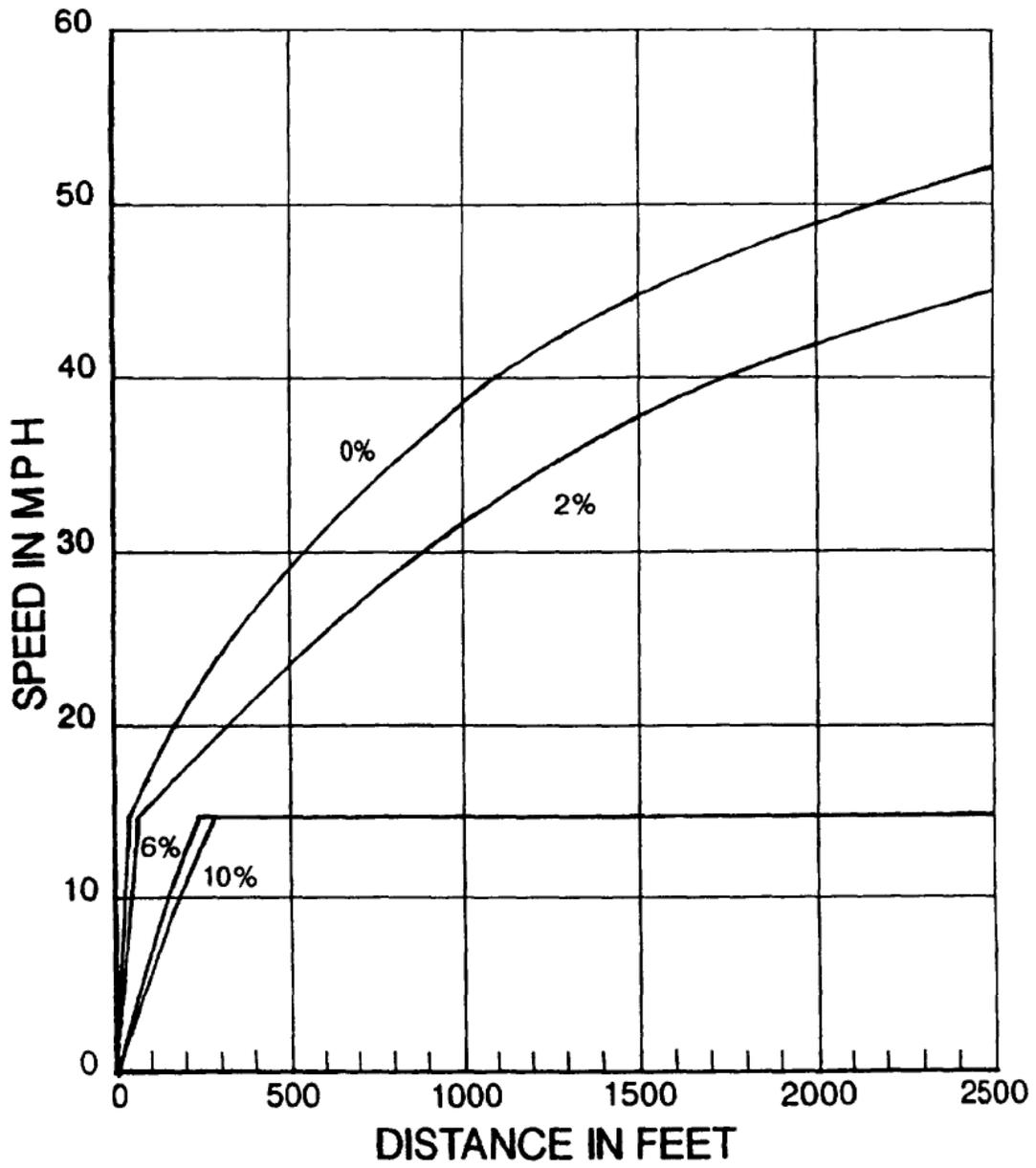


Figure 4 – Acceleration Characteristics of a 12,000 Pound Truck

F450 Performance, On-Road, on Slopes

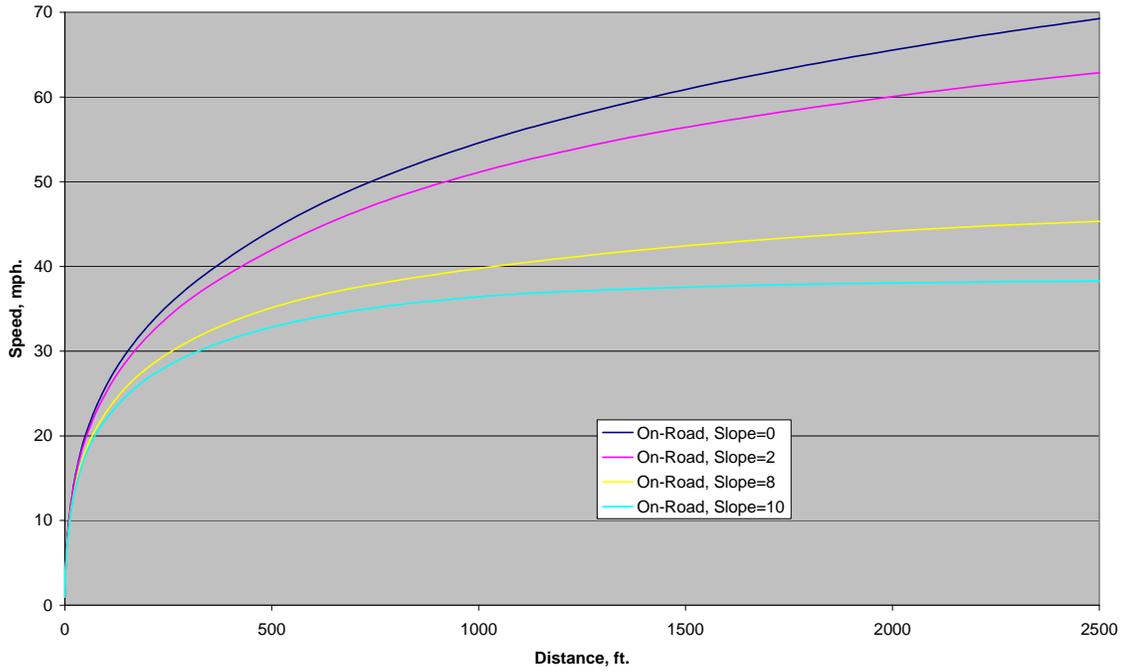
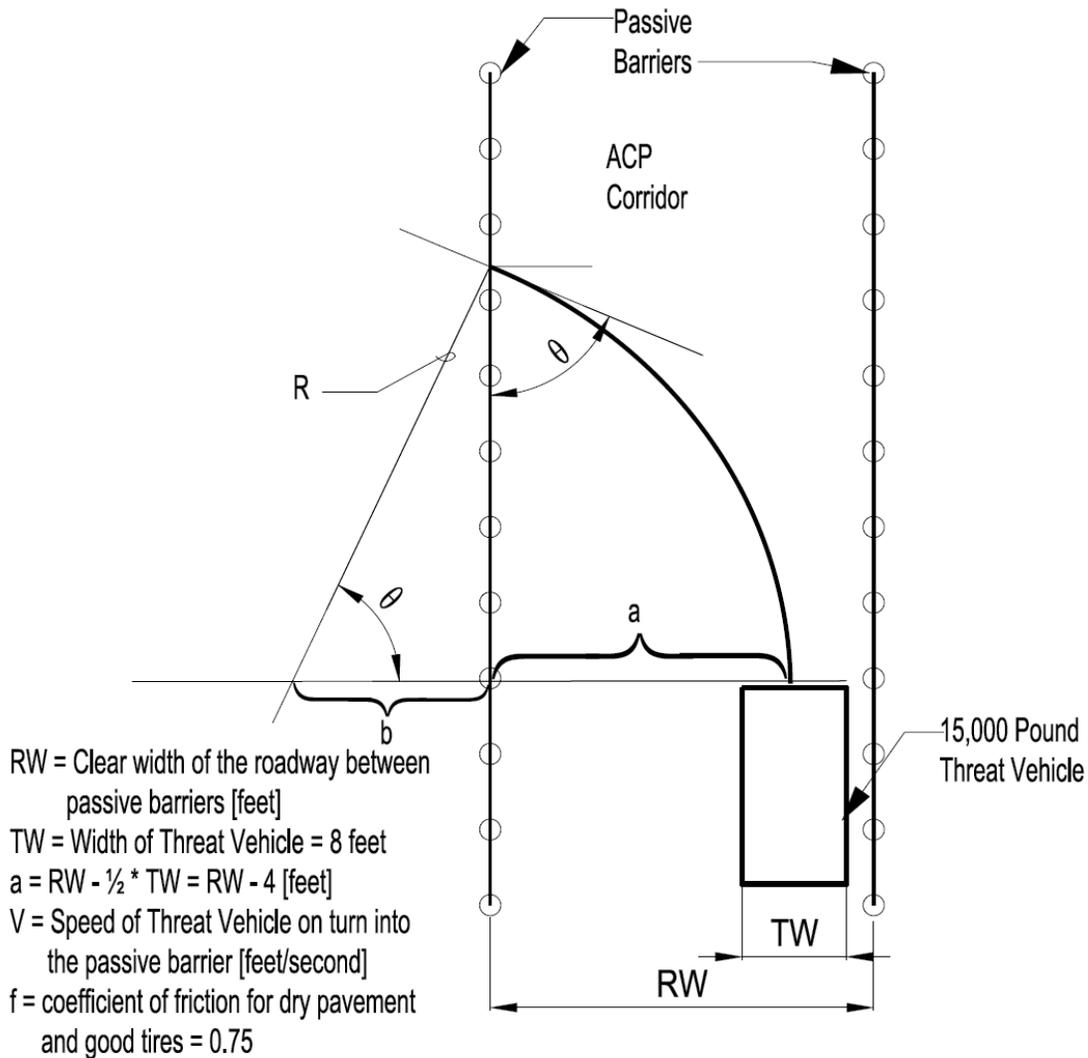


Figure 5 – Acceleration Characteristics of a Ford F450 with a 14,500 Pound Gross Vehicle Weight Rating (GVWR)



g = acceleration of gravity = 32.2 feet/second/second

R = Minimum radius of Threat Vehicle's turn into the barrier to avoid spinning out at a speed of V [feet]

$$R = \frac{V^2}{f \cdot g}$$

$$b = R - a \text{ [feet]}$$

$$\theta = \text{Impact angle of Threat Vehicle with barrier} = \text{ACos}(b/R)$$

W = Weight of Threat Vehicle = 15,000 pounds

M = Mass of Threat Vehicle = $W/g = 15,000/32.2 = 466$ Slugs

KE = Component of the Threat Vehicle's kinetic energy that is perpendicular to the barrier upon impact. This energy is the required stopping capacity of the passive barrier.

$$KE = \frac{1}{2} * M * (V * \text{Sin}(\theta))^2 \text{ [foot-pounds]}$$

FIGURE 6

THREAT VEHICLE IMPACT ANGLE ON A STRAIGHT ROADWAY

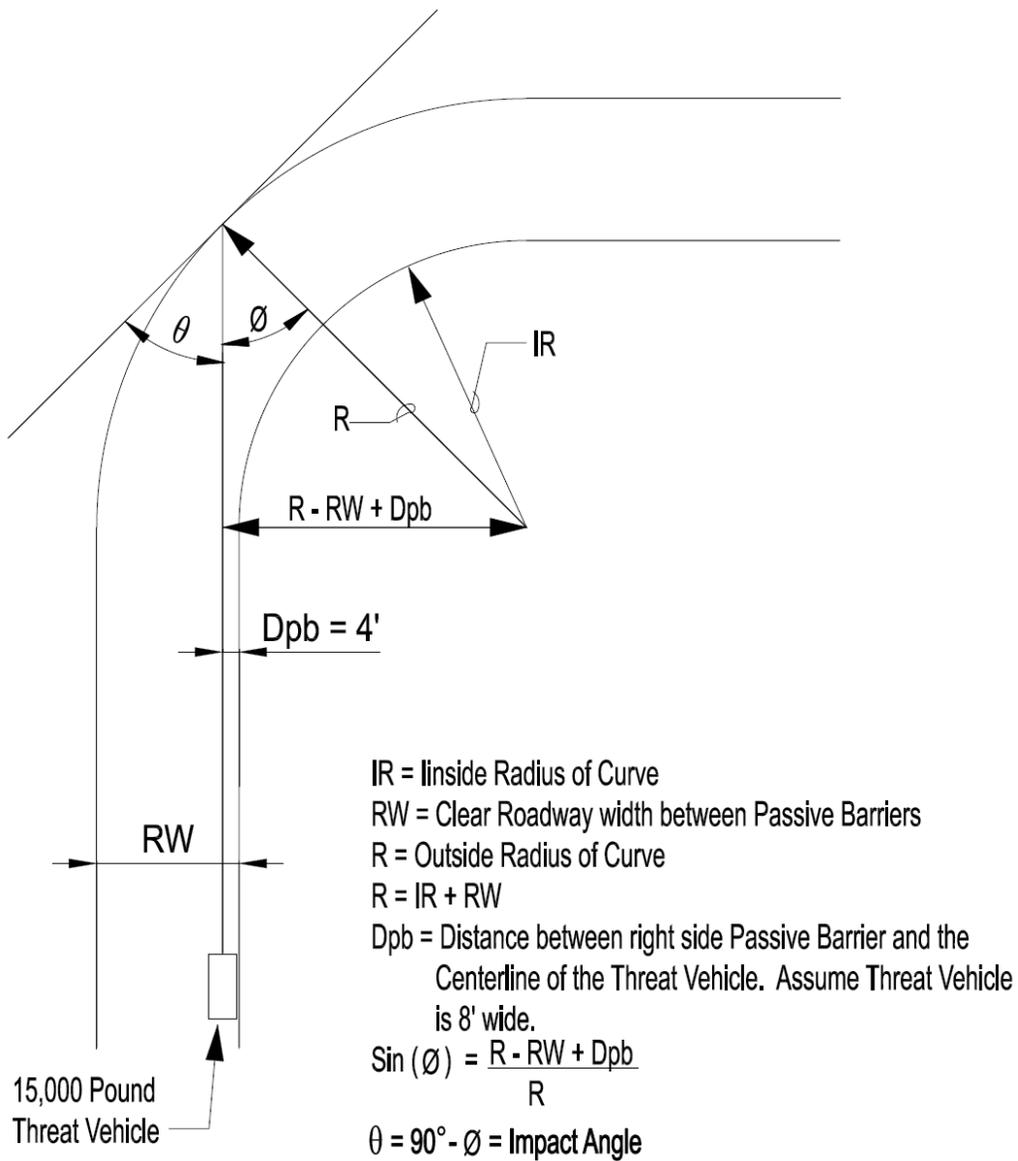


FIGURE 7
THREAT VEHICLE IMPACT ANGLE IN A CURVE

Attachment 1
Calculation Methods

A. Equations of Motion. Calculations showing that the threat scenarios will be defeated are based on the equations of motion, the most common of which are shown below:

1. $V = V_o + a*T$

2. $D = V_o*T + \frac{1}{2}*a*T^2$

3. $V^2 = V_o^2 + 2*a*D$

4. $D = (V^2 - V_o^2)/(2*a)$

5. $T = (-V_o + (V_o^2 + 2*a*D)^{1/2})/a$

a. V=final speed (feet per second)

b. V_o =initial speed (feet per second)

c. D=distance (feet)

d. T=time (seconds).

e. a=acceleration or deceleration (feet/second²)

i. Acceleration: The Design Criteria (Appendix B) sets the maximum acceleration of the threat vehicle at $a=11.3$ feet/second².

ii. Deceleration: The maximum deceleration rate of the threat vehicle (a_d) is calculated from the relationship $a_d=f*g$, where g is the acceleration of gravity (32.2 feet/second²) and f is the friction factor. From page 122, Figure III-IA in "A Policy on Geometric Design of Highways and Streets 1990" from the American Association of State Highway and Transportation Officials (AASHTO), $f=0.75$ for dry pavement and good tires. Therefore, $a_d=24.1$ feet/second².

B. Spin-out Speed. The spin-out speed V_s of a vehicle in a curve is:

1. $V_s=(R*g*(f+e))^{1/2}$, where

a. R is radius of the curve in feet,

b. g is the acceleration of gravity (32.2 feet/second²),

c. f is the friction factor (0.75), and

d. e is the super elevation of the roadway (from 0 to 0.04).

C. Accelerate and then Decelerate over Known Distance. To find the time for a vehicle to travel over a known distance D starting at a known initial speed V_i and ending at a known final speed V_f , use the following calculation method:

1. Calculate distances d_1 (which is the distance the vehicle will travel from the beginning of D to the point where it reaches a maximum speed) and d_2 (which is the distance vehicle will travel from the point of maximum speed to the end of D).
 - a. $d_1 = (V_f^2 - V_i^2 + 2 * a_d * D) / (2 * a + 2 * a_d)$
 - b. $d_2 = D - d_1$
2. Calculate the maximum speed V_m that the vehicle will reach before starting to decelerate. Recommend calculating V_m using both of the equations below to verify accuracy of previous calculations:
 - a. $V_m = (V_i^2 + 2 * a * d_1)^{1/2}$
 - b. $V_m = (V_f^2 + 2 * a_d * d_2)^{1/2}$
3. Calculate T_1 , T_2 , and T ; which are the times to go distances d_1 , d_2 , and D respectively.
 - a. $T_1 = (V_m - V_i) / a$
 - b. $T_2 = (V_m - V_f) / a_d$
 - c. $T = T_1 + T_2$

D. Range of Continuous Overspeed Detector. To find the required range of a continuous overspeed detector given the location and setting of the point overspeed detector immediately in front of it, use the following calculation method:

1. Solve the following 3 simultaneous equations assuming the vehicle will pass the point overspeed detector at just under its setting and then start to accelerate toward the range of the continuous overspeed detector:
 - a. $V_c = (V_p^2 + 2 * a * D_{pc})$, Where:
 - i. V_p is the setting of the point overspeed detector.
 - ii. V_c is the speed the vehicle will attain when it reaches the beginning of the continuous overspeed detector's range.
 - iii. D_{pc} is the distance between the point overspeed detector and the beginning of the range of the continuous overspeed detector.
 - b. $D_{cb} = V_c * t + 1/2 * a * t^2$, Where:
 - i. D_{cb} is the distance between the beginning of the range of the continuous overspeed detector and the final barrier and
 - ii. t is the required delay time (5 seconds for the Presence Detection Safety System and 9 seconds for the Signs and Signals Safety System).

c. $D_{pb}=D_{pc}+D_{cb}$, Where: D_{pb} is the known distance from the point overspeed detector to the final barrier.

2. Solving these 3 equations for D_{cb} results in a quadratic equation with the following parameters:

a. $A=1/t^2$

b. $B=a$

c. $C=a^2*t^2/4-V_p^2-2*a*D_{pb}$

d. $D_{cb}=(-B+(B^2-4*A*C)^{1/2})/(2*A)$

e. $D_{ci}=D_{cb}-D_{ib}$, Where:

i. D_{ib} is the know distance between the ID Check Point and the final barrier.

ii. D_{ci} is the required distance between the beginning of the range of the continuous overspeed detector and the ID Check Point. D_{ci} is then the required range of the continuous overspeed detector.

APPENDIX D

ATTACHMENTS 2 THRU 19

(The actual Excel Spreadsheets are in a Separate File Folder)

Attachment 2

**Example - Signs & Signals, Straight Roadway, Limited Entry Speed
No Overspeed Detection**

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance.	V_e	60 mph	88.0 f/s
Also assume that the end of the turn is D_{ei} feet in front of the ID Check Point.	D_{ei}	400 feet	
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenarios #1			
Since there is no overspeed detection, there is no Threat Scenario #2.			
With no advanced overspeed detection, the Threat Vehicle enters the ACP at the spin-out speed of the turn and begins to accelerate. By the time it reaches the ID Check Point, it is traveling at $V_i' = (V_e^2 + 2 * a * D_{ei})^{1/2}$	V_i'	129.55 f/s	88.3 mph
If V_i is greater than 100 mph, use $V_i=100$ as the criteria limits the Threat Vehicle's speed through the ID Check Point to no more than 100 mph.	V_i	129.55 f/s	88.3 mph
In the worst case, ACP guards will not detect the Threat Vehicle until it passes the ID Check Point. The point of detection is then the ID Check Point with the Threat Vehicle traveling at an initial speed of V_i The required distance D_{ib} from the ID Check Point to the Barrier must be $D_{ib} = V_i * t + 1/2 * a * t^2$	D_{ib}	1624 feet	

B Threat Scenario #3			
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib} = 1/2 * a * t^2$	D_{ib}	458 feet	

C Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25$ mph.	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t	t	7.0 sec	
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb} = V_d * t + 1/2 * a * t^2$	D_{tb}	534 feet	
The distance between the ID Check Point and the end of the last turnaround is D_{it}	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib} = D_{it} + D_{tb}$	D_{ib}	624 feet	

D Recommendations			
Distances required for Threat Scenarios #3 & #4 are much less than for Threat Scenario #1. Place the barriers at least D_{ib} feet (for Threat Scenario #1) from the ID Check Point.	D_{ib}	1624 feet	

Attachment 3

Example - Signs & Signals, Straight Roadway, Limited Entry Speed

One Zone of Continuous Overspeed Detection

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance. Enter V_e .	V_e	60 mph	88.0 f/s
Also assume that the ACP entrance is D_{ei} feet in front of the ID Check Point. Enter D_{ei} .	D_{ei}	500 feet	
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2			
<p>Assume there is sufficient distance in the Response Zone to place the barrier at D_{ib} feet beyond the ID Check Point. Install one zone of continuous overspeed detection immediately in front of the ID Check point. Set the alarm point at a speed V_{cs} to achieve the desired D_{ib}.</p> <p>In order to avoid early detection, the Threat Vehicle will stay just under V_{cs} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{cs}.</p>			
Enter the desirable distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	1118 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{cs} = (D_{ib} - 1/2 * a * t^2) / t$	V_{cs}	50.0 mph	73.4 f/s
The distance D_{eb} from the ACP entrance to the final barrier is $D_{eb} = D_{ei} + D_{ib}$	D_{eb}	1618 feet	

B Threat Scenarios #1 & #2			
<p>To find the required range of the continuous overspeed detector, assume the TV starts to accelerate from an initial speed of V_e immediately after it enters the ACP.</p> <p>The speed of the TV as it reaches the beginning of the continuous overspeed zone is $V_z = (V_e^2 + 2 * a * D_{ez})^{1/2}$, where D_{ez} is the distance between the ACP entrance and the beginning of the range of the continuous overspeed detector.</p> <p>The distance between the beginning of the range of the continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb} = V_z * t + 1/2 * a * t^2$</p> <p>The distance between the ACP entrance and the beginning of the range of the continuous overspeed detector is $D_{ez} = D_{eb} - D_{zb}$</p> <p>Solving these 3 equations for D_{zb} gives the following quadratic parameters:</p>			

$A=1/t^2$	A	0.012
$B=a$	B	11.300
$C=a^2*t^2/4-V_e^2-2*a*D_{eb}$	C	-41725
$D_{zb} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$	D_{zb}	1437 feet
$D_{ez}=D_{eb}-D_{zb}$	D_{ez}	181 feet
$V_z=(V_e^2+2*a*D_{ez})^{1/2}$	V_z	109 f/s
The range of the continuous overspeed detector is $D_{zi}=D_{zb}-D_{ib}$	D_{zi}	319 feet

D Threat Scenario #3		
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$		
	$D_{ib(3)}$	458 feet

E Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.			
	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t			
	t	7.0 sec	
In the required delay time, Threat Vehicle could travel			
$D_{tb}=V_t*t+1/2*a*t^2$	D_{tb}	534 feet	
Assume the distance between the ID Check Point and the end of the last turnaround is D_{it} .			
	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{tb}$			
	$D_{ib(4)}$	624 feet	

F Recommendations		
Distances $D_{ib(3)}$ and $D_{ib(4)}$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.		
	D_{ib}	1118 feet
Set continuous overspeed detector to reach from ID Check Point to a distance D_{zi} feet in front of ID Check Point.		
	D_{zi}	319 feet
Set continuous overspeed detector(s) at V_{cs} mph.		
	V_{cs}	50.0 mph

Note, if the range of the continuous overspeed zone needs to be reduced because of detector limitations or in order to reduce nuisance alarms (e.g., $D_{zi}>400'$), place a point overspeed detector at D_{zi} , set it at 10 mph over V_{cs} , and recalculate D_{zi} using the above procedure.

Attachment 4

**Example - Signs & Signals, Straight Roadway, Limited Entry Speed
Two Zones of Continuous Overspeed Detection**

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance.	V_e	60 mph	88.0 f/s
Also assume that the ACP entrance is D_{ei} feet in front of the ID Check Point.	D_{ei}	500 feet	
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2

<p>Assume the available distance D_{ib} beyond the ID Check Point to place the barrier is limited. Install two zones of continuous overspeed detection in front of the ID Check point. Set the alarm point of the zone immediately in front of the ID Check Point (Zone 2) to V_{c2} to achieve the available D_{ib}. Set the alarm point of the outer zone (Zone 1) at V_{c1}.</p> <p>In order to avoid early detection, the Threat Vehicle will stay just under both V_{c1} and V_{c2} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{c2}.</p>			
Enter the available distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	854 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{c2} = (D_{ib} - 1/2 * a * t^2) / t$	V_{c2}	30.0 mph	44.0 f/s
Set the Zone 1 detector 15 mph higher than the setting of the Zone 2 detector.	V_{c1}	45.0 mph	66.0 f/s
The range of the Zone 2 detector is then $D_{c2i} = (V_{c1} - V_{c2}) * t$	D_{c2i}	198 feet	
The distance D_{eb} from the ACP entrance to the final barrier is $D_{eb} = D_{ei} + D_{ib}$	D_{eb}	1354 feet	

B Threat Scenarios #1 & #2

<p>To find the required range of the Zone 1 continuous overspeed detector, assume the TV starts to accelerate from an initial speed of V_e immediately after it enters the ACP.</p> <p>The speed of the TV as it reaches the beginning of the Zone 1 continuous overspeed zone is $V_z = (V_e^2 + 2 * a * D_{ez})^{1/2}$, where D_{ez} is the distance between the ACP entrance and the beginning of the range of the Zone 2 continuous overspeed detector.</p> <p>The distance between the beginning of the range of the Zone 1 continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb} = V_z * t + 1/2 * a * t^2$</p>			
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The distance between the ACP entrance and the beginning of the range of the Zone 1 continuous overspeed detector is $D_{ez}=D_{eb}-D_{zb}$

Solving these 3 equations for D_{zb} gives the following quadratic parameters:

$A=1/t^2$	A	0.012
$B=a$	B	11.300
$C=a^2*t^2/4-V_p^2-2*a*D_{eb}$	C	-35759
$D_{zb} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$	D_{zb}	1305 feet
$D_{ez}=D_{eb}-D_{zb}$	D_{ez}	49 feet
$V_z=(V_e^2+2*a*D_{ez})^{1/2}$	V_z	94 f/s
The distance between the beginning of the Zone 1 detectors range and ID Check Point is $D_{zi}=D_{zb}-D_{ib}$	D_{zi}	451 feet

D Threat Scenario #3		
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$		
	$D_{ib(3)}$	458 feet

E Threat Scenario #4		
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.		
	V_t	25.0 mph 36.7 f/s
The required delay for Threat Scenario #4 is t		
	t	7.0 sec
In the required delay time, Threat Vehicle could travel $D_{tb}=V_t*t+1/2*a*t^2$.		
	D_{tb}	534 feet
Assume the distance between the ID Check Point and the end of the last turnaround is D_{it} .		
	D_{it}	90.0 feet
The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{tb}$		
	$D_{ib(4)}$	624 feet

F Recommendations		
Distances Dib(3) and Dib(4) required for Threat Scenarios #3 & #4 respectively are less than the Dib selected above. Place barrier a minimum distance of Dib from the ID Check Point.	D _{ib}	854 feet
Set the Zone 2 continuous overspeed detector at Vc2.	Vc2	30.0 mph
Set the Zone 2 continuous overspeed detector to reach from the ID Check Point to Dc2i in front of the ID Check Point.	Dc2i	198 feet
Set the Zone 1 continuous overspeed detector to reach from the beginning of the range of the Zone 2 continuous overspeed detector out to a distance Dc12 =Dzi-Dc2i.	Dc12	253 feet
The distance from the beginning of the Zone 1 detector's range to the ID Check Point is Dzi.	Dzi	451 feet
Set The Zone 1 continuous overspeed detector(s) at V _{c1} mph.	Vc1	45.0 mph

If the Zone 1 detectors are located at the ID Check Point, they must have a range of Dzi. For this case, If Dzi is less than 400 feet, point overspeed detectors are not required. However, if Dzi is greater than 400 feet for this case, place a point overspeed detector at Dzi, set it at 10 mph over Vc1, and recalculate Dzi using the above procedure.

Attachment 5

**Example - Signs & Signals, Straight Roadway, Unlimited Entry Speed
No Overspeed Detection**

Assumptions			
Because of the long, straight roadway running up to this ACP, the TV can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV will limit its speed (V_{imax}) at the ID Check point to 100 mph.	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s ²	
TV deceleration is a_d	a_d	24.1 f/s ²	

A Threat Scenarios #1	
<p>With no advanced overspeed detection, there is no Threat Scenario #2. In Threat Scenario #1, the Threat Vehicle begins its attack either inside or outside of the ACP at an initial high speed. However, the Threat Vehicle must slow down to a speed of V_{imax} as it enters the ID Check Point islands.</p> <p>In the worst case, ACP guards will not detect the Threat Vehicle until it passes the ID Check Point. The point of detection is then the ID Check Point with the Threat Vehicle traveling at an initial speed of V_{imax}.</p> <p>The required distance D_{ib} from the ID Check Point to the Barrier must be $D_{ib}=V_{imax}*t+1/2*a*t^2$</p>	<p>D_{ib} 1778 feet</p>

B Threat Scenario #3	
<p>Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib}=1/2*a*t^2$</p>	<p>D_{ib} 458 feet</p>

C Threat Scenario #4	
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25$ mph.	V_t 25.0 mph 36.7 f/s
The required delay for Threat Scenario #4 is t	t 7.0 sec
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb}=V_d*t+1/2*a*t^2$	D_{tb} 534 feet
The distance between the ID Check Point and the end of the last turnaround is D_{it}	D_{it} 90.0 feet
The required distance between the ID Check Point and barrier is $D_{ib}=D_{it}+D_{tb}$	D_{ib} 624 feet

D Recommendations

Distances required for Threat Scenarios #3 & #4 are much less than for Threat Scenarios #1 & #2.

Place the barriers at least D_{ib} feet (for Threat Scenarios #1 & #2) from the ID Check Point.

D_{ib} 1778 feet

Attachment 6

**Example - Signs & Signals, Straight Roadway, Unlimited Entry Speed
Two Point and One Zone of Continuous Overspeed Detection**

Assumptions			
Because of the long, straight roadway running up to this ACP, the Threat Vehicle (TV) can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV must limit its speed at the ID Check point to V_{imax} .	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2			
Assume there is sufficient distance in the Response Zone to place the barrier at D_{ib} feet beyond the ID Check Point. Install one zone of continuous overspeed detection immediately in front of the ID Check point. Set the alarm point at a speed V_{cs} to achieve the desired D_{ib} .			
In order to avoid early detection, the Threat Vehicle will stay just under V_{cs} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{cs} .			
Enter the desirable distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	1118 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{cs}=(D_{ib}-1/2*a*t^2)/t$	V_{cs}	50.0 mph	73.4 f/s

B Threat Scenario #1			
In Threat Scenario #1, the Threat Vehicle can enter the ACP at an extremely high speed, but must decelerate at some point to a speed of V_{imax} as it enters the ID Check Point.			
In order to contain the Threat Vehicle in Threat Scenario #1, the overspeed detector must detect the TV at a sufficient distance in front of the ID Check Point to achieve the required delay time.			
The TV's speed at the barrier is $V_b=(V_{imax}^2+2*a*D_{ib})^{1/2}$	V_b	216.3 f/s	147.5 mph
The time it takes the TV to go from the ID Check point to the barrier is $t_{ib}=(V_b-V_{imax})/a$	t_{ib}	6.16 sec	
The delay required from the point of detection to the ID Check point is $t_{di}=t-t_{ib}$, where t is the required delay time.	t_{di}	2.84 sec	

The fastest way the Threat Vehicle can reach the ID Check Point is by attaining a maximum speed at the point of detection and then decelerating to V_{imax} as it enters the ID Check Point islands. The maximum speed at the point of detection is	$V_d = V_{imax} + a_d * t_{di}$	V_d	215.1 f/s	146.7 mph
The distance D_{pi} between the point of detection and the ID Check point must be $D_{pi} = (V_d^2 - V_{imax}^2) / (2 * a_d)$		D_{pi}	514 feet	
Distance D_{pi} is greater than the effective range of the continuous overspeed detector required for Threat Scenario #2 above. So, in addition to the continuous overspeed detector, a point overspeed detector is required at distance D_{pi} from the ID Check Point. Set the point overspeed detector at V_p . Ensure that V_p is set at a high enough speed to limit the number of nuisance overspeed alarms. Enter V_p .		V_p	60 mph	88.0 f/s
The distance between the point overspeed detector and the barrier is $D_{pb} = D_{pi} + D_{ib}$		D_{pb}	1632 feet	

C Threat Scenario #2				
To find the required range of the continuous overspeed detector, assume the TV passes the point overspeed detector at just under its setting so as not to be detected and then starts to accelerate.				
The speed of the TV as it reaches the beginning of the continuous overspeed zone is $V_z = (V_p^2 + 2 * a * D_{pz})^{1/2}$, where D_{pz} is the distance between the point overspeed detector and the beginning of the range of the continuous overspeed detector.				
The distance between the beginning of the range of the continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb} = V_z * t + 1/2 * a * t^2$				
The distance between the point overspeed detector and the beginning of the range of the continuous overspeed detector is $D_{pz} = D_{pb} - D_{zb}$				
Solving these 3 equations for D_{zb} gives the following quadratic parameters:				
$A = 1/t^2$		A	0.012	
$B = a$		B	11.300	
$C = a^2 * t^2 / 4 - V_p^2 - 2 * a * D_{pb}$		C	-42032	
$D_{zb} = (-B + (B^2 - 4 * A * C)^{1/2}) / (2 * A)$		D_{zb}	1443 feet	
$D_{pz} = D_{pb} - D_{zb}$		D_{pz}	188 feet	
$V_z = (V_p^2 + 2 * a * D_{pz})^{1/2}$		V_z	110 f/s	
The range of the continuous overspeed detector is $D_{zi} = D_{zb} - D_{ib}$		D_{zi}	325 feet	

The effective range of continuous overspeed detectors vary from about 250 feet to 500 feet, depending on the type used. Also, a long D_{zi} may cause an excessive number of nuisance overspeed alarms.

If the required range (D_{zi}) needs to be reduced, locate a second point overspeed detector at a distance D_{zi} from the ID Check Point and set it at V_{p2} . Recalculate the required range of the continuous overspeed detector by assuming the Threat Vehicle will pass the second point overspeed detector at just under its setting of V_{p2} and then start to accelerate.

The distance from the second point overspeed detector to the barrier is $D_{p2b}=D_{zb}$ from above.

D_{p2b} 1443 feet

The distance from the second point overspeed detector to the ID Check Point is $D_{p2i}=D_{p2b}-D_{ib}$.

D_{p2i} 325 feet

Set the second point overspeed detector at a setting V_{p2} that is high enough to limit the number of nuisance overspeed alarms. Enter V_p .

V_{p2} 55.0 mph 80.7 f/s

The speed of the TV as it reaches the beginning of the continuous overspeed zone is now $V_z=(V_{p2}^2+2*a*D_{p2z})^{1/2}$, where D_{p2z} is the distance between the second point overspeed detector and the beginning of the range of the continuous overspeed detector.

The distance between the beginning of the range of the continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb}=V_z*t+1/2*a*t^2$

The distance between the second point overspeed detector and the beginning of the range of the continuous overspeed detector is $D_{p2z}=D_{p2b}-D_{zb}$

Solving these 3 equations for D_{zb} gives the following quadratic parameters:

$A=1/t^2$ A 0.012

$B=a$ B 11.300

$C=a^2*t^2/4-V_{p2}^2-2*a*D_{p2b}$ C -36543

$D_{zb} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$ D_{zb} 1323 feet

$D_{p2z}=D_{p2b}-D_{zb}$ D_{p2z} 121 feet

$V_z=(V_{p2}^2+2*a*D_{p2z})^{1/2}$ V_z 96.1 f/s

The range of the continuous overspeed detector is then

$D_{zi}=D_{zb}-D_{ib}$ D_{zi} 205 feet

D Threat Scenario #3			
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib}(3)=1/2*a*t^2$			
	$D_{ib}(3)$	458 feet	

E Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.			
	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t			
	t	7.0 sec	
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb}=V_t*t+1/2*a*t^2$			
	D_{tb}	534 feet	
The distance between the ID Check Point and the end of the last turnaround is D_{it}			
	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib}(4)=D_{it}+D_{tb}$			
	$D_{ib}(4)$	624 feet	

F Recommendations			
Distances $D_{ib}(3)$ and $D_{ib}(4)$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.			
	D_{ib}	1118 feet	
Locate the the first point overspeed detector(s) at D_{pi} feet in front of the ID Check point.			
	D_{pi}	514 feet	
Set the first point overspeed detector at V_p .			
	V_p	60 mph	
Locate the second overspeed detector at D_{p2i} feet in front of the ID Check Point.			
	D_{p2i}	325 feet	
Set the second point overspeed detector at V_{p2} .			
	V_{p2}	55 mph	
Set continuous overspeed detector to reach from ID Check Point to a distance D_{zi} feet in front of ID Check Point.			
	D_{zi}	205 feet	
Set continuous overspeed detector(s) at V_{cs} mph.			
	V_{cs}	50.0 mph	
Check that D_{zi} is within the range of the selected continuous overspeed detectors.			

Notes:

1

If the range of the continuous overspeed zone needs to be reduced because of detector limitations or in order to reduce nuisance alarms (e.g., $D_{zi}>400'$), install a second continuous overspeed detector. See Attachment 7 for calculation method.

2 If D_{zi} is less than 200', eliminate the second point overspeed detector and recalculate D_{zi} .

Attachment 7

**Example - Signs & Signals, Straight Roadway, Unlimited Entry Speed
Two Point and Two Zones of Continuous Overspeed Detection**

Assumptions			
Because of the long, straight roadway running up to this ACP, the TV can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV will limit its speed (V_{imax}) at the ID Check point to 100 mph.	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	t	9 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	
In order to defeat the high speed threat scenarios, provide 2 continuous zones of overspeed detection and point overspeed detection at two points.			

A Threat Scenario #2			
Assume the available distance D_{ib} beyond the ID Check Point to place the barrier is limited. Install two zones of continuous overspeed detection in front of the ID Check point. Set the alarm point of the zone immediately in front of the ID Check Point (Zone 2) to V_{c2} to achieve the available D_{ib} . Set the alarm point of the outer zone (Zone 1) at V_{c1} .			
In order to avoid early detection, the Threat Vehicle will stay just under both V_{c1} and V_{c2} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{c2} .			
Enter the available distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	854 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{c2}=(D_{ib}-1/2*a*t^2)/t$	V_{c2}	30.0 mph	44.0 f/s
Set the Zone 1 detector 15 mph higher than the setting of the Zone 2 detector.	V_{c1}	45.0 mph	66.0 f/s

B Threat Scenario #1			
In Threat Scenario #1, the Threat Vehicle can enter the ACP at an extremely high speed, but must decelerate at some point to a speed of V_{imax} as it enters the ID Check Point.			
In order to contain the Threat Vehicle in Threat Scenario #1, the overspeed detector must detect it at a sufficient distance in front of the ID Check Point to achieve the required delay time.			
The TV's speed at the barrier is $V_b=(V_{imax}^2+2*a*D_{ib})^{1/2}$	V_b	202.0 f/s	137.7 mph
The time it takes the TV to go from the ID Check point to the barrier is $t_{ib}=(V_b-V_{imax})/a$	t_{ib}	4.90 sec	

Setting the range of the Zone 1 continuous overspeed detector out to D_{z1i} may cause an excessive number of nuisance alarms. Instead, locate a second point overspeed detector at D_{z1i} and set it at a higher speed (V_{p2}) to reduce nuisance alarms.

Recalculate the required range of the Zone 1 continuous overspeed detector by assuming the Threat Vehicle will pass the second point overspeed detector at just under V_{p2} before it starts to accelerate.

The distance between the second point overspeed detector and the barrier is $D_{p2b}=D_{z1b}$ D_{p2b} 1456 feet

The distance between the second point overspeed detector and the ID Check Point is $D_{p2i}=D_{p2b}-D_{ib}$ D_{p2i} 602 feet

Set second point overspeed detector at V_{p2} . Enter V_{p2} . V_{p2} 50.0 mph 73.3 f/s

The speed of the TV as it reaches the beginning of the Zone 1 continuous overspeed zone becomes $V_z=(V_{p2}^2+2*a*D_{p2z})^{1/2}$, where D_{p2z} is the distance between the second point overspeed detector and the beginning of the range of the Zone 1 continuous overspeed detector.

The distance between the beginning of the range of the Zone 1 continuous overspeed detector and the barrier (D_{z1b}) must provide t seconds of delay, so $D_{z1b}=V_z*t+1/2*a*t^2$

The distance between the second point overspeed detector and the beginning of the range of the Zone 1 continuous overspeed detector is $D_{p2z}=D_{p2b}-D_{z1b}$

Solving these 3 equations for D_{z1b} gives the following quadratic parameters:

$A=1/t^2$ A 0.012

$B=a$ B 11.300

$C=a^2*t^2/4-V_{p2}^2-2*a*D_{p2b}$ C -35703

$D_{z1b} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$ D_{z1b} 1303 feet

$D_{p2z}=D_{p2b}-D_{z1b}$ D_{p2z} 153 feet

$V_z=(V_{p2}^2+2*a*D_{p2z})^{1/2}$ V_z 94.0 f/s

The range of the Zone 1 continuous overspeed detector is then $D_{z1z2}=D_{z1b}-D_{ib}-D_{z2i}$ D_{z1z2} 251 feet

The distance between the beginning of the Zone 1 range to the ID Check Point is $D_{z1i}=D_{z1b}-D_{ib}$ D_{z1i} 449 feet

D Threat Scenario #3

Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib}(3)=1/2*a*t^2$ $D_{ib}(3)$ 458 feet

E Threat Scenario #4

Threat Scenario #4 begins at the end of the last turn-around with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t	t	7.0 sec	
In the required delay, Threat Vehicle could travel			
$D_{ib}=V_t*t+1/2*a*t^2$	D_{ib}	534 feet	
Assume the distance between the ID Check Point and the end of the last turn-around is D_{it} .	D_{it}	90 feet	
The required distance between the ID Check Point and barrier is			
$D_{ib(4)}=D_{it}+D_{ib}$	$D_{ib(4)}$	624 feet	

F Recommendations			
Distances $D_{ib(3)}$ and $D_{ib(4)}$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.	D_{ib}	854 feet	
Locate the first point overspeed detector at D_{pi} feet in front of the ID Check Point.	D_{pi}	804 feet	
Set the first overspeed detector at V_p .	V_p	60 mph	
Locate the second overspeed detector at D_{p2i} feet in front of the ID Check Point.	D_{p2i}	602 feet	
Set the second point overspeed detector at V_{p2} .	V_{p2}	50 mph	
Set the range of the Zone 1 continuous overspeed detector to D_{z1z2} .	D_{z1z2}	251 feet	
Set the Zone 1 continuous overspeed detector at V_{c1}	V_{c1}	45.0 mph	
Set the range of the Zone 2 continuous overspeed detector at D_{z2i} .	D_{z2i}	198 feet	
Set the Zone 2 continuous overspeed detector at V_{c2} .	V_{c2}	30.0 mph	
Note the distance between the beginning of the Zone 1 continuous overspeed detector and the ID Check Point is $D_{z1i}=D_{z1b}-D_{ib}$	D_{z1i}	449 feet	
If the Zone 1 detector is located at the ID Check Point, the detector must have a range of D_{z1i} .			

Notes

- 1 The locations and settings of the overspeed detectors described above are necessary to limit the required distance between the ID Check Point and the barrier to D_{ib} . However, these detector locations and settings may cause nuisance alarms. To minimize nuisance alarms, recommend that the Installation initiate a program to educate ACP users on the necessity to abide by posted speed limits and an enforcement program to punish motorist who exceed speed limits. Speed calming means ahead of the ID Check Point such as rumble strips should also be considered along with proper signage including variable message signs that display motorists actual speed along with the posted speed limit.

Attachment 8

**Example - Presence Detection, Straight Roadway, Limited Entry Speed
No Overspeed Detection**

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance.	V_e	60 mph	88.0 f/s
Also assume that the end of the turn is D_{ei} feet in front of the ID Check Point.	D_{ei}	400 feet	
Delay time for S&S Safety System is t	t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenarios #1			
Since there is no overspeed detection, there is no Threat Scenario #2.			
With no advanced overspeed detection, the Threat Vehicle enters the ACP at the spin-out speed of the turn and begins to accelerate. By the time it reaches the ID Check Point, it is traveling at $V_i' = (V_e^2 + 2 * a * D_{ei})^{1/2}$	V_i'	129.55 f/s	88.3 mph
If V_i is greater than 100 mph, use $V_i = 100$ as the criteria limits the Threat Vehicle's speed through the ID Check Point to no more than 100 mph.	V_i	129.55 f/s	88.3 mph
In the worst case, ACP guards will not detect the Threat Vehicle until it passes the ID Check Point. The point of detection is then the ID Check Point with the Threat Vehicle traveling at an initial speed of V_i			
The required distance D_{ib} from the ID Check Point to the Barrier must be $D_{ib} = V_i * t + 1/2 * a * t^2$	D_{ib}	789 feet	

B Threat Scenario #3			
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib} = 1/2 * a * t^2$	D_{ib}	141 feet	

C Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t = 25$ mph.	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t	t	3.0 sec	
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb} = V_d * t + 1/2 * a * t^2$	D_{tb}	161 feet	
The distance between the ID Check Point and the end of the last turnaround is D_{it}	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib} = D_{it} + D_{tb}$	D_{ib}	251 feet	

D Recommendations

Distances required for Threat Scenarios #3 & #4 are much less than for Threat Scenario #1. Place the barriers at least D_{ib} feet (for Threat Scenario #1) from the ID Check Point.

D_{ib} 789 feet

Attachment 9

**Example - Presence Detection, Straight Roadway, Limited Entry Speed
One Zone of Continuous Overspeed Detection**

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance. Enter V_e .	V_e	50 mph	73.3 f/s
Also assume that the ACP entrance is D_{ei} feet in front of the ID Check Point. Enter D_{ei} .	D_{ei}	600 feet	
Delay time for S&S Safety System is t	t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2			
<p>Assume there is sufficient distance in the Response Zone to place the barrier at D_{ib} feet beyond the ID Check Point. Install one zone of continuous overspeed detection immediately in front of the ID Check point. Set the alarm point at a speed V_{cs} to achieve the desired D_{ib}.</p> <p>In order to avoid early detection, the Threat Vehicle will stay just under V_{cs} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{cs}.</p>			
Enter the desirable distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	508 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{cs}=(D_{ib}-1/2*a*t^2)/t$	V_{cs}	50.0 mph	73.4 f/s
The distance D_{eb} from the ACP entrance to the final barrier is $D_{eb}=D_{ei}+D_{ib}$	D_{eb}	1108 feet	

B Threat Scenarios #1 & #2			
<p>To find the required range of the continuous overspeed detector, assume the TV starts to accelerate from an initial speed of V_e immediately after it enters the ACP.</p> <p>The speed of the TV as it reaches the beginning of the continuous overspeed zone is $V_z=(V_e^2+2*a*D_{ez})^{1/2}$, where D_{ez} is the distance between the ACP entrance and the beginning of the range of the continuous overspeed detector.</p> <p>The distance between the beginning of the range of the continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb}=V_z*t+1/2*a*t^2$</p> <p>The distance between the ACP entrance and the beginning of the range of the continuous overspeed detector is $D_{ez}=D_{eb}-D_{zb}$</p> <p>Solving these 3 equations for D_{zb} gives the following quadratic parameters:</p>			

$A=1/t^2$	A	0.040
$B=a$	B	11.300
$C=a^2*t^2/4-V_e^2-2*a*D_{eb}$	C	-29621
$D_{zb} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$	D_{zb}	731 feet
$D_{ez}=D_{eb}-D_{zb}$	D_{ez}	377 feet
$V_z=(V_e^2+2*a*D_{ez})^{1/2}$	V_z	118 f/s
The range of the continuous overspeed detector is $D_{zi}=D_{zb}-D_{ib}$	D_{zi}	223 feet

D Threat Scenario #3		
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$		
	$D_{ib(3)}$	141 feet

E Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.			
	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t			
	t	3.0 sec	
In the required delay time, Threat Vehicle could travel			
$D_{tb}=V_t*t+1/2*a*t^2$	D_{tb}	161 feet	
Assume the distance between the ID Check Point and the end of the last turnaround is D_{it} .			
	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{tb}$			
	$D_{ib(4)}$	251 feet	

F Recommendations		
Distances $D_{ib(3)}$ and $D_{ib(4)}$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.		
	D_{ib}	508 feet
Set continuous overspeed detector to reach from ID Check Point to a distance D_{zi} feet in front of ID Check Point.		
	D_{zi}	223 feet
Set continuous overspeed detector(s) at V_{cs} mph.		
	V_{cs}	50.0 mph

Note, if the range of the continuous overspeed zone needs to be reduced because of detector limitations or in order to reduce nuisance alarms (e.g., $D_{zi}>400'$), place a point overspeed detector at D_{zi} , set it at 10 mph over V_{cs} , and recalculate D_{zi} using the above procedure.

Attachment 10

**Example - Presence Detection, Straight Roadway, Limited Entry Speed
Two Zones of Continuous Overspeed Detection**

Assumptions			
Assume that the ACP corridor is straight, but that there is a required turn or turns to get into the corridor, which limit vehicle speed to V_e at the ACP entrance.	V_e	50 mph	73.3 f/s
Also assume that the ACP entrance is D_{ei} feet in front of the ID Check Point.	D_{ei}	600 feet	
Delay time for S&S Safety System is t	t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2

<p>Assume the available distance D_{ib} beyond the ID Check Point to place the barrier is limited. Install two zones of continuous overspeed detection in front of the ID Check point. Set the alarm point of the zone immediately in front of the ID Check Point (Zone 2) to V_{c2} to achieve the available D_{ib}. Set the alarm point of the outer zone (Zone 1) at V_{c1}.</p> <p>In order to avoid early detection, the Threat Vehicle will stay just under both V_{c1} and V_{c2} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{c2}.</p>			
Enter the available distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	361 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{c2} = (D_{ib} - 1/2 * a * t^2) / t$	V_{c2}	30.0 mph	44.0 f/s
Set the Zone 1 detector 15 mph higher than the setting of the Zone 2 detector.	V_{c1}	45.0 mph	66.0 f/s
The range of the Zone 2 detector is then $D_{c2i} = (V_{c1} - V_{c2}) * t$	D_{c2i}	110 feet	
The distance D_{eb} from the ACP entrance to the final barrier is $D_{eb} = D_{ei} + D_{ib}$	D_{eb}	961 feet	

B Threat Scenarios #1 & #2

<p>To find the required range of the Zone 1 continuous overspeed detector, assume the TV starts to accelerate from an initial speed of V_e immediately after it enters the ACP.</p> <p>The speed of the TV as it reaches the beginning of the Zone 1 continuous overspeed zone is $V_z = (V_e^2 + 2 * a * D_{ez})^{1/2}$, where D_{ez} is the distance between the ACP entrance and the beginning of the range of the Zone 2 continuous overspeed detector.</p> <p>The distance between the beginning of the range of the Zone 1 continuous overspeed detector and the barrier (D_{zb}) must provide t seconds of delay, so $D_{zb} = V_z * t + 1/2 * a * t^2$</p>			
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The distance between the ACP entrance and the beginning of the range of the Zone 1 continuous overspeed detector is $D_{ez}=D_{eb}-D_{zb}$

Solving these 3 equations for D_{zb} gives the following quadratic parameters:

$A=1/t^2$	A	0.040
$B=a$	B	11.300
$C=a^2*t^2/4-V_p^2-2*a*D_{eb}$	C	-26298
$D_{zb} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$	D_{zb}	682 feet
$D_{ez}=D_{eb}-D_{zb}$	D_{ez}	279 feet
$V_z=(V_e^2+2*a*D_{ez})^{1/2}$	V_z	108 f/s
The distance between the beginning of the Zone 1 detectors range and ID Check Point is $D_{zi}=D_{zb}-D_{ib}$	D_{zi}	321 feet

D Threat Scenario #3

Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$

$D_{ib(3)}$ 141 feet

E Threat Scenario #4

Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25$ mph.

V_t 25.0 mph 36.7 f/s

The required delay for Threat Scenario #4 is t

t 3.0 sec

In the required delay time, Threat Vehicle could travel $D_{tb}=V_t*t+1/2*a*t^2$.

D_{tb} 161 feet

Assume the distance between the ID Check Point and the end of the last turnaround is D_{it} .

D_{it} 90.0 feet

The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{tb}$

$D_{ib(4)}$ 251 feet

F Recommendations

Distances $D_{ib(3)}$ and $D_{ib(4)}$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.

D_{ib} 361 feet

Set the Zone 2 continuous overspeed detector at V_{c2} .

V_{c2} 30.0 mph

Set the Zone 2 continuous overspeed detector to reach from the ID Check Point to D_{c2i} in front of the ID Check Point.

D_{c2i} 110 feet

Set the Zone 1 continuous overspeed detector to reach from the beginning of the range of the Zone 2 continuous overspeed detector out to a distance $D_{c12} = D_{zi} - D_{c2i}$.

D_{c12} 211 feet

The distance from the beginning of the Zone 1 detector's range to the ID Check Point is D_{zi} .

D_{zi} 321 feet

Set The Zone 1 continuous overspeed detector(s) at V_{c1} mph.

V_{c1} 45.0 mph

Note, if D_{zi} is less than 400 feet, point overspeed detectors are not required. If D_{zi} is greater than 400 feet, place a point overspeed detector at D_{zi} , set it at 10 mph over V_{cs} , and recalculate D_{zi} using the above procedure.

Attachment 11

**Example - Presence Detection, Straight Roadway, Unlimited Entry Speed
No Overspeed Detection**

Assumptions			
Because of the long, straight roadway running up to this ACP, the TV can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV will limit its speed (V_{imax}) at the ID Check point to 100 mph.	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	Time t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s ²	
TV deceleration is a_d	a_d	24.1 f/s ²	

A Threat Scenarios #1			
<p>With no advanced overspeed detection, there is no Threat Scenario #2. In Threat Scenario #1, the Threat Vehicle begins its attack either inside or outside of the ACP at an initial high speed. However, the Threat Vehicle must slow down to a speed of V_{imax} as it enters the ID Check Point islands.</p> <p>In the worst case, ACP guards will not detect the Threat Vehicle until it passes the ID Check Point. The point of detection is then the ID Check Point with the Threat Vehicle traveling at an initial speed of V_{imax}.</p> <p>The required distance D_{ib} from the ID Check Point to the Barrier must be $D_{ib}=V_{imax} * t + 1/2 * a * t^2$</p>			
	D_{ib}	875 feet	

B Threat Scenario #3			
<p>Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib}=1/2 * a * t^2$</p>			
	D_{ib}	141 feet	

C Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25$ mph.	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t	t	3.0 sec	
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb}=V_d * t + 1/2 * a * t^2$	D_{tb}	161 feet	
The distance between the ID Check Point and the end of the last turnaround is D_{it}	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib}=D_{it}+D_{tb}$	D_{ib}	251 feet	

D Recommendations

Distances required for Threat Scenarios #3 & #4 are much less than for Threat Scenarios #1 & #2. Place the barriers at least D_{ib} feet (for Threat Scenarios #1 & #2) from the ID Check Point.

D_{ib} 875 feet

Attachment 12

**Example - Presence Detection, Straight Roadway, Unlimited Entry Speed
One Zone of Continuous Overspeed Detection**

Assumptions			
<p>Because of the long, straight roadway running up to this ACP, the Threat Vehicle (TV) can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV must limit its speed at the ID Check point to V_{imax}.</p>			
	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	

A Threat Scenario #2			
<p>Assume there is sufficient distance in the Response Zone to place the barrier at D_{ib} feet beyond the ID Check Point. Install one zone of continuous overspeed detection immediately in front of the ID Check point. Set the alarm point at a speed V_{cs} to achieve the desired D_{ib}.</p> <p>In order to avoid early detection, the Threat Vehicle will stay just under V_{cs} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{cs}.</p>			
Enter the desirable distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	508 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{cs}=(D_{ib}-1/2*a*t^2)/t$	V_{cs}	50.0 mph	73.4 f/s

B Threat Scenario #1			
In Threat Scenario #1, the Threat Vehicle can enter the ACP at an extremely high speed, but must decelerate at some point to a speed of V_{imax} as it enters the ID Check Point.			
In order to contain the Threat Vehicle in Threat Scenario #1, the overspeed detector must detect the TV at a sufficient distance in front of the ID Check Point to achieve the required delay time.			
The TV's speed at the barrier is $V_b=(V_{imax}^2+2*a*D_{ib})^{1/2}$	V_b	181.6 f/s	123.8 mph
The time it takes the TV to go from the ID Check point to the barrier is $t_{ib}=(V_b-V_{imax})/a$	t_{ib}	3.09 sec	
The delay required from the point of detection to the ID Check point is $t_{di}=t-t_{ib}$, where t is the required delay time.	t_{di}	1.91 sec	
The fastest way the Threat Vehicle can reach the ID Check Point is by attaining a maximum speed at the point of detection and then decelerating to V_{imax} as it enters the ID Check Point islands. The maximum speed at the point of detection is $V_d=V_{imax}+a_d*t_{di}$			
The distance D_{pi} between the point of detection and the ID Check point must be $D_{pi}=(V_d^2-V_{imax}^2)/(2*a_d)$	D_{pi}	323 feet	
The range of the continuous overspeed detector is then $D_{zi}=D_{pi}$	D_{zi}	323 feet	

D Threat Scenario #3			
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$			
	$D_{ib(3)}$	141 feet	

E Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turnaround with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.			
The required delay for Threat Scenario #4 is t	t	3.0 sec	
In the required delay time of 7 seconds, Threat Vehicle will travel $D_{tb}=V_t*t+1/2*a*t^2$	D_{tb}	161 feet	
The distance between the ID Check Point and the end of the last turnaround is D_{it}	D_{it}	90.0 feet	
The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{tb}$	$D_{ib(4)}$	251 feet	

F Recommendations		
Distances Dib(3) and Dib(4) required for Threat Scenarios #3 & #4 respectively are less than the Dib selected above. Place barrier a minimum distance of Dib from the ID Check Point.	D _{ib}	508 feet
Set continuous overspeed detector to reach from ID Check Point to a distance D _{zi} feet in front of ID Check Point.	D _{zi}	323 feet
Set continuous overspeed detector(s) at V _{cs} mph.	V _{cs}	50.0 mph
D _{zi} is within the range of most continuous overspeed detectors.		

Note, if the range of the continuous overspeed zone needs to be reduced because of detector limitations or in order to reduce nuisance alarms (e.g., D_{zi}>400'), install a point or a second continuous overspeed detector. See Attachments 6 and 13 respectively for calculation method.

Attachment 13

**Example - Presence Detection, Straight Roadway, Unlimited Entry Speed
One Point and Two Zones of Continuous Overspeed Detection**

Assumptions			
Because of the long, straight roadway running up to this ACP, the TV can attain an extremely high speed. Its speed approaching the ACP is limited only by the narrow lanes and traffic islands at the ID Check point. In order to successfully get through the ID Check point without hitting ID Check point features, the TV will limit its speed (V_{imax}) at the ID Check point to 100 mph.	V_{imax}	100 mph	146.7 f/s
Delay time for S&S Safety System is t	t	5 sec	
Threat Vehicle acceleration rate is a	a	11.3 f/s/s	
TV deceleration is a_d	a_d	24.1 f/s/s	
In order to defeat the high speed threat scenarios, provide 2 continuous zones of overspeed detection and point overspeed detection at one point.			

A Threat Scenario #2			
Assume the available distance D_{ib} beyond the ID Check Point to place the barrier is limited. Install two zones of continuous overspeed detection in front of the ID Check point. Set the alarm point of the zone immediately in front of the ID Check Point (Zone 2) to V_{c2} to achieve the available D_{ib} . Set the alarm point of the outer zone (Zone 1) at V_{c1} .			
In order to avoid early detection, the Threat Vehicle will stay just under both V_{c1} and V_{c2} until it reaches the ID Check Point and then it will start to accelerate. Point of detection is the ID Check Point with the Threat Vehicle traveling at a speed of V_{c2} .			
Enter the available distance D_{ib} from the ID Check point to the Barrier:	D_{ib}	361 feet	
In order to travel distance D_{ib} in the required time delay of t seconds, the Threat Vehicle's speed at the ID Check Point must be no greater than $V_{c2} = \sqrt{2a_d t^2 + V_{imax}^2}$	V_{c2}	30.0 mph	44.0 f/s
Set the Zone 1 detector 15 mph higher than the setting of the Zone 2 detector.	V_{c1}	45.0 mph	66.0 f/s

B Threat Scenario #1			
<p>In Threat Scenario #1, the Threat Vehicle can enter the ACP at an extremely high speed, but must decelerate at some point to a speed of V_{imax} as it enters the ID Check Point.</p> <p>In order to contain the Threat Vehicle in Threat Scenario #1, the overspeed detector must detect it at a sufficient distance in front of the ID Check Point to achieve the required delay time.</p>			
The TV's speed at the barrier is $V_b=(V_{imax}^2+2*a*D_{ib})^{1/2}$	V_b	172.2 f/s	117.4 mph
The time it takes the TV to go from the ID Check point to the barrier is $t_{ib}=(V_b-V_{imax})/a$	t_{ib}	2.26 sec	
The delay required from the point of detection to the ID Check point is then $t_{di}=t-t_{ib}$, where t is the required delay time.	t_{di}	2.74 sec	
<p>The fastest way the Threat Vehicle can reach the ID Check Point is by attaining a maximum speed at the point of detection and then decelerating to V_{imax} as it enters the ID Check Point islands.</p>			
The maximum speed at the point detector is then $V_d=V_{imax}+a_d*t_{di}$	V_d	212.6 f/s	145.0 mph
The minimum distance D_{pi} between the point of detection and the ID Check point must be $D_{pi}=(V_d^2-V_{imax}^2)/(2*a_d)$	D_{pi}	491 feet	
Locate the point overspeed detector at D_{pi} feet in front of the ID Check Point and set it at $V_{p.Enter}$ V_p .	V_p	60 mph	88.0 f/s
The distance between the point overspeed detector and the barrier is $D_{pb}=D_{pi}+D_{ib}$	D_{pb}	852 feet	
C Threat Scenario #2			
The required range for the Zone 2 continuous overspeed detector is $D_{z2i}=(V_1-V_2)*t$	D_{z2i}	110 feet	
<p>To find the required range of the Zone 1 continuous overspeed detector, assume the TV passes the point overspeed detector at just under its setting so as not to be detected and then starts to accelerate.</p> <p>The speed of the TV as it reaches the beginning of the range of the Zone 1 detector is $V_{z1}=(V_p^2+2*a*D_{pz1})^{1/2}$, where D_{pz1} is the distance between the point overspeed detector and the beginning of the range of the Zone 1 detector.</p> <p>The distance between the beginning of the range of the Zone 1 detector and the barrier (D_{z1b}) must provide t seconds of delay, so $D_{z1b}=V_{z1}*t+1/2*a*t^2$</p> <p>The distance between the point overspeed detector and the beginning of the range of the Zone 1 detector is $D_{pz1}=D_{pb}-D_{z1b}$</p> <p>Solving these 3 equations for D_{z1b} gives the following quadratic parameters:</p>			
$A=1/t^2$	A	0.040	
$B=a$	B	11.300	
$C=a^2*t^2/4-V_p^2-2*a*D_{pb}$	C	-26212	
$D_{z1b} = (-B+(B^2-4*A*C)^{1/2})/(2*A)$	D_{z1b}	680 feet	
$D_{pz1}=D_{pb}-D_{z1b}$	D_{pz1}	172 feet	
$V_{z1}=(V_p^2+2*a*D_{pz1})^{1/2}$	V_{z1}	108 f/s	
The distance between the beginning of the range of the Zone 1 continuous overspeed detector and the ID Check Point is $D_{z1i}=D_{z1b}-D_{ib}$.	D_{z1i}	319 feet	

The range of the Zone 1 continuous overspeed detector is $D_{z12}=D_{z1i}-D_{z2i}$	D_{z12}	209 feet
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D Threat Scenario #3		
Threat Scenario 3 begins at the ID Check Point with the Threat Vehicle traveling at an initial speed of 0 mph. In the required delay time, Threat Vehicle will travel $D_{ib(3)}=1/2*a*t^2$	$D_{ib(3)}$	141 feet

E Threat Scenario #4			
Threat Scenario #4 begins at the end of the last turn-around with the Threat Vehicle traveling at an initial velocity of $V_t=25\text{mph}$.	V_t	25.0 mph	36.7 f/s
The required delay for Threat Scenario #4 is t	t	3.0 sec	
In the required delay, Threat Vehicle could travel $D_{ib}=V_t*t+1/2*a*t^2$	D_{ib}	161 feet	
Assume the distance between the ID Check Point and the end of the last turn-around is D_{it} .	D_{it}	90 feet	
The required distance between the ID Check Point and barrier is $D_{ib(4)}=D_{it}+D_{ib}$	$D_{ib(4)}$	251 feet	

F Recommendations			
Distances $D_{ib(3)}$ and $D_{ib(4)}$ required for Threat Scenarios #3 & #4 respectively are less than the D_{ib} selected above. Place barrier a minimum distance of D_{ib} from the ID Check Point.	D_{ib}	361 feet	
Locate the point overspeed detector at D_{pi} feet in front of the ID Check Point.	D_{pi}	491 feet	
Set the point overspeed detector at V_p .	V_p	60 mph	
Set the range of the Zone 1 continuous overspeed detector to D_{z1z2} .	D_{z1z2}	209 feet	
Set the Zone 1 continuous overspeed detector at V_{c1} .	V_{c1}	45.0 mph	
Set the range of the Zone 2 continuous overspeed detector at D_{z2i} .	D_{z2i}	110 feet	
Set the Zone 2 continuous overspeed detector at V_{c2} .	V_{c2}	30.0 mph	
Note the distance between the beginning of the Zone 1 continuous overspeed detector and the ID Check Point is D_{z1i} .	D_{z1i}	319 feet	
If the Zone 1 detector is located at the ID Check Point, the detector must have a range of D_{z1i} .			

Notes

1

The locations and settings of the overspeed detectors described above are necessary to limit the required distance between the ID Check Point and the barrier to D_{ib} . However, these detector locations and settings may cause nuisance alarms. To minimize nuisance alarms, recommend that the Installation initiate a program to educate ACP users on the necessity to abide by posted speed limits and an enforcement program to punish motorists who exceed speed limits. Speed calming means ahead of the ID Check Point such as rumble strips should also be considered along with proper signage including variable message signs that display motorists actual speed along with the posted speed limit.

Attachment 14

Example - Curve in Response Zone, Signs and Signals Safety System
No Overspeed Detection

Parameters of the ACP:			
Curve in the Response Zone with a inside radius IR =	IR	130	feet
Roadway Width is RW=	RW	50	feet
Curve Angle in degrees: CA =	CA	90	deg
Radius of threat vehicle path is (see Note 1) $R=(IR+3)+(RW-6)/(1-\cos(CA/2))$	R	282	feet
Spinout speed in curve = $V_c=(R*g*(f+s))^{0.5}$, where $g=32.2f/s/s$, $f=0.75$, and $s=0.03$.	V_c	84.2 f/s	57.404 mph
Signs and Signals Safety System where required delay time =	t	9	sec
Acceleration of Threat Vehicle: a =	a	11.3	f/s/s
Deceleration of Threat Vehicle: a_d =	a_d	24.1	f/s/s
Distance from ID Check Point to end of last Turn-around: D_{it}	D_{it}	90	feet
Distance from ID Check Point to curve: D_{iv}	D_{iv}	225	feet
Distance from beginning of the TV's path in the turn to the beginning of the curve: $X=(RW-6)*\sin(CA/2)/(1-\cos(CA/2))$	X	106	feet
Distance from ID Check Point to beginning of TV's path in the curve: $D_{ic}=D_{iv}-X$ (see Note 1)	D_{ic}	119	feet

Threat Scenarios #1 and #2:	
For the high speed threat scenarios (TS #1) with no advanced overspeed detection, the point of detection is the ID Check Point.	
Path of the vehicle from the point of detection is as follows:	
ID Check Point to beginning of TV's path in the curve: D_{ic}	D_{ic}
Distance of TV's path through curve: D_c	D_c
End of TV's path in the curve to final barriers: D_{cb}	D_{cb}
Given D_{ic} and D_c , determine required length of D_{cb} to defeat threat.	

Maximum speed of Threat Vehicle in the curve (V_c) from above	V_c	84.2 f/s	
V_i =maximum speed of threat vehicle at the ID Check Point to be able to decelerate to V_c at beginning of curve = $(V_c^2 + 2 * a_d * D_{ic})^{1/2}$	V_i	77.2 mph	113.2 f/s
Time for TV to travel from ID Check Point (point of detection) to the curve is $T_{ic} = (V_i - V_c) / a_d$	T_{ic}	1.2 sec	
Distance thru curve: $d_c = 2 * \pi * R * CA / 360$	d_c	443 feet	
Time to go thru curve: $t_c = d_c / V_c$	t_c	5.3 sec	
Additional time required to delay Threat Vehicle for T_d seconds: $t_r = t - T_{ic} - t_c$	t_r	2.5 sec	
Additional straight line distance required to delay Threat Vehicle for t_r seconds: $D_{cb} = V_c * t_r + 1/2 * a * t_r^2$	D_{cb}	249 feet	
Required distance between ID Check Area and the final barrier: $D_{ib} = D_{ic} + d_c + D_{cb}$	D_{ib}	811 feet	

Threat Scenario #3:

In this Threat Scenario, The threat vehicle's initial speed at the point of detection (ID Check point) is $V_o = 0$ mph, so this scenario is a less case than Threat Scenarios 1&2 above where V_i is much higher.

Threat Scenario #4:

In this Threat Scenario, the threat vehicle is detected at the end of the last Turn-around traveling at the ACP speed limit ($V_o = 25$ mph).

V_o 25 mph 36.7 f/s

Since the guards have identified this vehicle as a possible threat, guard reaction time is reduced from 3 to 1 seconds and the overall delay time is reduced from 9 to 7 seconds.

t 7 sec

The distance from the end of the last Turn-around to the beginning of TV's path in the Curve is $D_{tc} = D_{ic} - D_{it}$

D_{tc} 29 feet

The threat vehicle will start to accelerate at end of the Turn-around from a speed of V_o to a maximum speed (V_m) and then decelerate to the curve's spinout speed V_c at the entrance to the curve.	V_c	84.2 f/s
Distance from end of Turn-around to get to point where Threat Vehicle speed is V_m : d_1	d_1	
Distance for Threat Vehicle to decelerate from the point where its speed is V_m to the beginning of the curve: $d_2 = d_{tc} - d_1$	d_2	
Time to travel d_1 : t_1	t_1	
Time to travel d_2 : t_2	t_2	
Distance thru curve: $d_c = 2 * \pi * R * CA / 360$	d_c	
Time to go thru curve: $t_c = d_c / V_c$	t_c	
Additional time required to delay Threat Vehicle for T_d seconds: $t_r = T_d - t_1 - t_2 - t_c$	t_r	
Additional straight line distance to go in t_r seconds: $D_{cb} = V_c * t_r + 1/2 * a * t_r^2$	D_{cb}	

Solution Method:		
$V_m^2 = V_o^2 + 2 * a * d_1$		
$V_m^2 = V_c^2 + 2 * a_d * d_2$		
$V_o^2 + 2 * a * d_1 = V_c^2 + 2 * a_d * d_2$		
$d_2 = D_{tc} - d_1$		
$2 * a * d_1 - 2 * a_d * (D_{tc} - d_1) = V_c^2 - V_o^2 + 2 * a_d * d$		
$d_1 = (V_c^2 - V_o^2 + 2 * a_d * D_{tc}) / (2 * a + 2 * a_d) =$	d_1	101 feet
$d_2 = D_{tc} - d_1 =$	d_2	-72 feet
$V_m = (V_o^2 + 2 * a * d_1)^{1/2} =$	V_m	60.2 f/s
$V_m = (V_c^2 + 2 * a_d * d_2)^{1/2} =$	V_m	60.2 f/s
$t_1 = (V_m - V_o) / a =$	t_1	2.08 sec
$t_2 = (V_m - V_c) / a_d =$	t_2	-1.00 sec
$d_c = 2 * \pi * R * CA / 360$	d_c	443 feet
$t_c = d_c / V_c$	t_c	5.27 sec
$t_{ic} = t_c + t_1 + t_2 > t$, so TS#4 is contained	t_{ic}	6.35 sec

Summary		
Distance between ID Check Point and Curve, $D_{iv} =$	D_{iv}	225 feet
Distance between the beginning of the TV's path in the curve and the beginning of the curve: X	X	106 feet
Distance through the TV's path in the Curve, d_c	d_c	443 feet
Distance between end of TV's path in the Curve and barrier, $D_{cb} =$	D_{cb}	249 feet
Distance between ID Check Point and barrier, $D_{ib} =$	D_{ib}	811 feet

Notes:
1 See Figure 7 - Path of Threat Vehicle in a Curve/Turn
2 In order to reduce D_{cb} , overspeed detection can be provided in front of the ID Check Point. See example in Attachment 8.

Attachment 15

Example - Turn in Response Zone, Signs and Signals Safety System Point and One Zone of Continuous Overspeed Detection

ACP has a turn in the Response Zone that is beyond the ID Check Point.

Parameters of the ACP		
D_{it} = Distance between ID Check Point and beginning of the turn.	D_{it}	400 feet
X = Distance between the beginning of the TV's path in the turn and beginning of the turn, $X=(RW-6)*\sin(CA/2)/(1-\cos(CA/2))$. (see Note 1)	X	63 feet
D_{ic} = Distance between ID Check Point and beginning of the TV's path in the turn: $D_{ic}=D_{it}-X$	D_{ic}	336.6 feet
Inside radius of turn = IR	IR	130 feet
Roadway width through turn = RW	RW	26 feet
Turn Angle of turn = CA	CA	70 deg
Radius of threat vehicle path is (see Note 1) $R=(IR+3)+(RW-6)/(1-\cos(CA/2))$	R	243 feet
Spinout speed in turn = $V_c=(R*g*(f+s))^{0.5}$, where $g=32.2\text{f/s/s}$, $f=0.75$, and $s=0.03$.	V_c	78.1 f/s
a =TV acceleration rate =	a	11.3 f/s/s
a_d =TV deceleration rate =	a_d	24.1 f/s/s
t =required time delay	t	9 s

Threat Scenario #2		
Do Threat Scenario #2 first to determine time for Threat Vehicle to go from ID Check Point to turn (T_{ic}).		
In TS#2, TV will begin attack at the ID Check Point and start to accelerate to a maximum speed V_m between the Check Point and the turn and then start to decelerate to V_c as it enters the turn.		
V_i = TV speed at ID Check Point (point of detection), which is the setting of the continuous overspeed detector =	V_i	35 mph 51.3 f/s
$V_m^2=V_i^2+2*a*d_1$, where d_1 is the distance between the ID Check Point and the point where the TV reaches V_m .		
$V_m^2=V_c^2+2*a_d*d_2$, where d_2 is the distance between the turn and the point where the TV reaches V_m .		
$D_{ic}=d_1+d_2$		
Combining the above three equations in terms of d_1 :		
$d_1=(V_c^2-V_i^2+2*a_d*D_{ic})/(2*a+2*a_d)$	d_1	278 feet
$d_2=D_{ic}-d_1$	d_2	59 feet

$V_m=(V_i^2+2*a*d_1)^{1/2}$	V_m	94.4 f/s
$V_m=(V_c^2+2*a_d*d_2)^{1/2}$	V_m	94.4 f/s
$t_1=\text{time to go distance } d_1=(V_m-V_i)/a$	t_1	3.81 sec
$t_2=\text{time to go distance } d_2=(V_m-V_c)/a_d$	t_2	0.68 sec
$T_{ic}=t_1+t_2$	T_{ic}	4.49 sec
The remaining time delay (t-T _{ic}) must be achieved in the turn and in the straight roadway distance between the end of the turn and barrier.		

Threat Scenario #1			
Determine distance between point overspeed detector (which is the point of detection for TS#1) and the turn.			
In TS#1, TV enters ACP at high speed, however, at some point it must start to decelerate to reach speed V _c at the beginning of the turn.			
The point overspeed detector must be placed at a distance from the turn to be able to detect the TV in the same amount of time as the TV was detected in TS#2 from the point of detection to the beginning of the turn. This time is T _{ic} for TS#2 above.			
In the worst case, the TV will be decelerating at this point, so its speed is $V_p=V_c+a_d*T_{ic}$.	V_p	186.3 f/s	127.1 mph
Distance between the point overspeed detector and the turn is $D_{pc}=V_p*T_{ic}-1/2*a_d*T_{ic}^2$	D_{pc}	594 feet	
Distance between the point overspeed detector and the ID Check Point is $D_{pi}=D_{pc}-D_{ic}$	D_{pi}	257 feet	

Threat Scenario #2			
Determine the range of the continuous overspeed detector (D _{zi})			
The other attack option in TS#2 is that the TV will pass the point overspeed detector at just under its setting (V _p) and then begin to accelerate. The continuous OS detector will detect this attack at the beginning of its range of coverage.			
	V_p	55 mph	80.7 f/s
From the point OS Detector, the TV will begin to accelerate from a speed of V _p to a speed of V _m and then start to decelerate in order to get to a speed of V _c at the entrance to the turn.			
$V_m^2=V_p^2+2*a*d_1$			
$V_m^2=V_c^2+2*a_d*d_2$			
Also, $D_{pc}=d_1+d_2$			

Combining the above 3 equations in terms of d_1 :		
$d_1=(V_c^2-V_p^2+2*a_d*D_{pc})/(2*a+2*a_d)$	d_1	399 feet
$d_2=D_{pc}-d_1$	d_2	195 feet
$V_m=(V_p^2+2*a*d_1)^{1/2}$	V_m	125 f/s
$V_m=(V_c^2+2*a*d_2)^{1/2}$	V_m	125 f/s
$t_1=(V_m-V_p)/a$	t_1	3.88 sec
$t_2=(V_m-V_c)/a_d$	t_2	1.93 sec
$T_{pc}=t_1+t_2$	T_{pc}	5.81 sec
The time it takes the TV to go from the beginning of the continuous OS detector (point of detection) to the turn must be no greater than T_{ic} calculated for TS#2 above.		
The time it takes the TV to go from the point OS detector to the beginning of the continuous OS detector's zone is then $T_{pz}=T_{pc}-T_{ic}$		
	T_{pz}	1.32 sec
The speed of the TV at the beginning of the continuous OS detector's zone is then $V_z=V_p+a*T_{pz}$		
	V_z	95.6 f/s
Distance between point OS detector and the beginning of the continuous OS detector's zone is then $D_{pz}=V_p*T_{pz}+1/2*a*T_{pz}^2$		
	D_{pz}	116 feet
Length of continuous OS detector's zone is $D_{zi}=D_{pi}-D_{pz}$		
	D_{zi}	141 feet
Distance in turn is $D_c=2*\pi*R*CA/360$		
	D_c	296 feet
The time to get through the turn is $T_c=D_c/V_c$		
	T_c	3.80 sec
Remaining delay time required is $T_r=t-T_{ic}-T_c$		
	T_r	0.71 sec
Straight line distance required from the end of the TV's path in the turn to the barriers is $D_{cb}=V_c*T_r+1/2*a*T_r^2$		
	D_{cb}	58 feet
Required distance between the ID Check Point and barrier is $D_{ib}=D_{ic}+D_c+D_{cb}$		
	D_{ib}	691 feet

Threat Scenario #3	
In TS#3, TV begins attack at ID Check Point at a speed of 0 mph. This is a much less case than TS#2, which also begins at the ID Check Point but at a much higher speed.	
TS#3 can be ignored in this example.	

Threat Scenario #4			
In Threat Scenario #4, the TV begins the attack at the end of the last Turn-around, which is a distance D_{it} from the ID Check Point.	D_{it}	90 feet	
Delay time TS#4 is $t=$	t	7 sec	
Distance between the end of the last Turn-around, which is the point of detection, and the turn is $D_{tc}=D_{ic}-D_{it}$	D_{tc}	246.6 feet	
At the end of the last Turn-around, TV will begin to accelerate from an initial speed of $V_i=25$ mph to a maximum speed of V_m and then start to decelerate to V_c as it enters the turn.	V_t	25 mph	36.7 f/s
$V_m^2=V_t^2+2*a*d_1$			
$V_m^2=V_c^2+2*a_d*d_2$			
$D_{tc}=d_1+d_2$			
Combining the above 3 equations in terms of d_1 :			
$d_1=(V_c^2-V_t^2+2*a_d*D_{tc})/(2*a+2*a_d)$	d_1	234.9 feet	
$d_2=D_{tc}-d_1$	d_2	11.64 feet	
$V_m=(V_t^2+2*a*d_1)^{1/2}$	V_m	81.57 f/s	
$V_m+(V_c^2+2*a_d*d_2)^{1/2}$	V_m	81.57 f/s	
$t_1=(V_m-V_i)/a$	t_1	3.974 sec	
$t_2=(V_m-V_c)/a_d$	t_2	0.146 sec	
$T_{tc}=t_1+t_2$	T_{tc}	4.12 sec	
Time for TV to go through turn is T_c from above.	T_c	3.80 sec	
Time for TV to go from end of last Turn-around to end of turn is $T_{tec}=T_{tc}+T_c$	T_{tec}	7.92 sec	
Since T_{tec} is greater than the required delay time t , TS#4 is contained.			
Summary			
Distance between ID Check Point and turn, $D_{it}=$	D_{it}	400 feet	
Distance between the beginning of the TV's path in the turn and the beginning of the turn, X	X	63 feet	
Distance between end of turn and Barrier, $D_{cb}=$	D_{cb}	58 feet	
Distance between ID Check Point and barrier, $D_{ib}=$	D_{ib}	691 feet	
Distance between point overspeed detector and the ID Check Point, D_{pi}	D_{pi}	257 feet	
Setting of the point overspeed detector, V_p	V_p	55 mph	
Range of the continuous overspeed detector, D_{zi}	D_{zi}	141 feet	
Setting of the continuous overspeed detector, V_i	V_i	35 mph	
Notes:			
1 See Figure 7 - Path of Threat Vehicle in a Curve/Turn.			

Attachment 16

Example - Curve in Response Zone, Presence Detection Safety System
No Speed Detection

Parameters of the ACP:		
Curve in the Response Zone with a inside radius IR =	IR	130 feet
Roadway Width is RW=	RW	26 feet
Curve Angle in degrees: CA =	CA	70 deg
Radius of threat vehicle path is (see Note 1) $R=(IR+3)+(RW-6)/(1-\cos(CA/2))$	R	243 feet
Spinout speed in curve = $V_c=(R*g*(f+s))^{0.5}$, where $g=32.2f/s/s$, $f=0.75$, and $s=0.03$.	V_c	78.1 f/s
Length of Threat Vehicle path through the curve is $D_c=2*\pi*R*CA/360$	D_c	296 feet
Time for Threat Vehicle to traverse the curve is $T_c=D_c/V_c$	T_c	3.8 sec
Signs and Signals Safety System where required delay time =	t	5 sec
Acceleration of Threat Vehicle: a =	a	11.3 f/s/s
Deceleration of Threat Vehicle: a_d =	a_d	24.1 f/s/s
Distance from ID Check Point to end of last Turn-around: D_{it}	D_{it}	90 feet
Distance from ID Check Point to beginning of the curve: D_{iv}	D_{iv}	100 feet
Distance from the beginning of the TV's path in the curve and the beginning of the curve: $X=(RW-6)*\sin(CA/2)/(1-\cos(CA/2))$ (Note 1)	X	63 feet
Distance from ID Check Point to beginning of TV's path in the curve: $D_{ic}=D_{iv}-X$	D_{ic}	37 feet

Threat Scenarios #1 and #2:	
For the high speed threat scenarios (TS #1) with no advanced overspeed detection, the point of detection is the ID Check Point.	
Path of the vehicle from the point of detection is as follows:	
ID Check Point to beginning of curve: D_{ic}	D_{ic}
Distance through curve: D_c	D_c

End of curve to final barriers: D_{cb}	D_{cb}		
Given D_{ic} and D_c , determine required length of D_{cb} to defeat threat.			
Maximum speed of Threat Vehicle in the curve (V_c) from above	V_c	78.1 f/s	
V_i =maximum speed of threat vehicle at the ID Check Point to be able to decelerate to V_c at beginning of curve = $(V_c^2 + 2*a_d*D_{ic})^{1/2}$	V_i	60.4 mph	88.6 f/s
Time for TV to travel from ID Check Point (point of detection) to the curve is $T_{ic}=(V_i-V_c)/a_d$			
T_{ic}		0.4 sec	
Distance thru curve: $d_c = 2*\pi*R*CA/360$	d_c	296.4 feet	
Time to go thru curve = d_c/V_c	t_c	3.797 sec	
Additional time required to delay Threat Vehicle for T_d seconds: $t_r = t - T_{ic} - t_c$	t_r	0.8 sec	
Additional straight line distance required to delay Threat Vehicle for t_r seconds:			
$D_{cb} = V_c*t_r + 1/2*a*t_r^2$	D_{cb}	63 feet	
Required distance between ID Check Area and the final barrier: $D_{ib} = D_{ic} + d_c + D_{cb}$	D_{ib}	395.9 feet	

Threat Scenario #3:			
In this Threat Scenario, The threat vehicle's initial speed at the point of detection (ID Check point) is $V_o=0$ mph, so this scenario is a less case than Threat Scenarios 1&2 above where V_i is much higher.			

Threat Scenario #4:			
In this Threat Scenario, the threat vehicle is detected at the end of the last Turn-around traveling at the ACP speed limit ($V_o=25$ mph).			
V_o		25 mph	36.7 f/s
Since the guards have identified this vehicle as a possible threat, guard reaction time is reduced from 3 to 1 seconds and the overall delay time is reduced 2 seconds.			
t		3 sec	

Since the time delay in the curve (t_c) is greater than the required time delay, Threat Scenario #4 will be defeated.

Summary		
Distance between ID Check Point and beginning of curve, D_{ic}	D_{iv}	100 feet
Distance between beginning of TV's path in the curve and the beginning of the curve, X	X	63 feet
Distance between ID Check Point and Curve, $D_{ic} =$	D_{ic}	37 feet
Distance between end of Curve and Barrier, $D_{cb} =$	D_{cb}	63 feet
Distance between ID Check Point and barrier, $D_{ib} =$	D_{ib}	396 feet

Notes:	
1	See Figure 7 - Path of Threat Vehicle in a Curve/Turn
2	For the Presence Detection Safety System, most of the required delay can be achieved in a properly selected curve. Advance speed detection should, therefore, not be necessary.

Attachment 17

Example - Curve in Approach Zone, Signs and Signals Safety System
No Speed Detection

Parameters of the ACP:			
The approach roadway to the ACP corridor has a turn into the ACP corridor with a radius of R =	IR	65 feet	
Roadway width is RW =	RW	26 feet	
Curve Angle of turn is CA=	CA	90 deg	
Radius of threat vehicle path is (see Note 1) $R=(IR+3)+(RW-6)/(1-\cos(CA/2))$	R	136 feet	
Spinout speed in curve = $V_c=(R*g*(f+s))^{0.5}$, where $g=32.2f/s/s$, $f=0.75$, and $s=0.03$. See Note 2.	V_c	58.5 f/s	39.9 mph
Signs and Signals Safety System where required delay time is t =	t	9 sec	
Acceleration of Threat Vehicle: a =	a	11.3 f/s/s	
Distance from the end of the turn to the ID Check Point: D_{ti} =	D_{ti}	50 feet	
No advanced speed detection.			

Threat Scenarios 1&2 - High Speed Attacks			
The maximum speed in the turn is V_t = (See Notes 2 & 3)	V_t	58.5 f/s	39.9 mph
The Threat Vehicle will start to accelerate from the end of the turn and will continue to accelerate to the barrier.			
The worst case point of detection is the ID Check Point at which point the TV will be traveling at $V_d=(V_t^2+2*a*D_{ti})^{1/2}$	V_d	67.5 f/s	
The required distance between the ID Check Point and the barrier is $D_{ib}=V_d*t+1/2*a*t^2$	D_{ib}	1065 feet	

Threat Scenario #3 - Covert at ID Check point.			
TV begins attack at ID Check Point, where it is immediately detected by the ID Check guard.			
TV's speed at the point of detection is $V_d=0$ f/s.	V_d	0 mph	0.0 f/s
Total distance Threat Vehicle can travel from the point of detection (ID Check point) in the required t seconds of delay is	D_{ib}		
$= V_d*t+1/2*a*t^2$	$D_{ib}(3)$	458 feet	

D_{ib} for Threat Scenario #3 is considerably smaller than D_{ib} calculated above for Threat Scenarios 1&2, so use D_{ib} for Threat Scenarios 1&2.

Threat Scenario #4 - Covert at end of last Turn around.		
Threat vehicle begins attack at the end of the last Turn at which point it is immediately detected by ID Check guards. The TV's speed at the point of detection is the ACP speed limit, so $V_d=25$ mph.	V_d	25 mh 36.7 f/s
Since TV has been identified by guards as suspect, guard reaction time to initiate EFO is reduced from 3 to 1 seconds, thus reducing overall delay time to $t = 7$ seconds	t	7 sec
The distance between the ID Check point and the end of the last Turn around is D_{it} .	D_{it}	90 feet
Total distance Threat Vehicle can travel from the point of detection (end of last Turn around) in the required t seconds of delay is $D_{tb} = V_d*t + 1/2*a*t^2$	D_{tb}	534 feet
Required distance from ID Check Point to the barrier to defeat Threat Scenario #4 is $D_{ib} = D_{it} + D_{tb}$	$D_{ib(4)}$	624 feet
D_{ib} for Threat Scenario #4 is considerably smaller than D_{ib} calculated above for Threat Scenarios 1&2, so use the D_{ib} calculated for Threat Scenarios 1&2.		

Summary		
To defeat TS 1&2, a large distance D_{ib} is required. Even with the fairly tight turning radius in this example, the turn in the Approach Zone does not significantly reduce the required distance D_{ib} . See note 3.	D_{ib}	1065 feet

Notes:		
1 See Figure 7 - Path of Threat Vehicle in a Curve/Turn.		
2 If $V_c > 35$ mph, the turn has little value in providing delay. Use examples for Straight Approach to ACP Corridor.		

3

In order to be effective, Approach Zone speed management features must have narrow lanes and must be brought up fairly close to the ID Check Point, which will help keep the Threat Vehicle's speed low at the ID Check Point (point of detection). This is not possible at a multi-lane, high volume gate, but may be possible at a low volume, single entry lane gate.

Attachment 18

Example - Serpentine at beginning of Response Zone, Signs and Signals Safety

Parameters of the ACP:			
Serpentine at beginning of Response Zone with spacing between barriers (s)	s	55 feet	
Number of barriers in serpentine is N. Note, the minimum number of barriers to make a serpentine is 3.	N	3	
Roadway Width is RW=	RW	26 feet	
From Figure 9, The spinout speed in a Serpentine with s spacing between barriers is $V_s = s/2$ mph	V_s	40.3 f/s	27.5 mph
Signs and Signals Safety System where required delay time =	t	9 sec	
Acceleration of Threat Vehicle: a =	a	11.3 f/s/s	
Deceleration of Threat Vehicle: a_d =	a_d	24.1 f/s/s	
Distance from ID Check Point to end of last Turn-around: D_{it}	D_{it}	90 feet	
Distance from ID Check Area to serpentine is D_{is} =	D_{is}	95 feet	

Threat Scenarios #1 and #2:			
<p>For the high speed threat scenarios (TS #1&#2) with no advanced overspeed detection, the point of detection is the ID Check Point. Path of the Threat Vehicle (TV) from the point of detection is as follows: ID Check Point to beginning of the serpentine:</p>			
D_{is}	D_{is}		
Distance through serpentine: D_s	D_s		
End of serpentine to final barriers: D_{cb}	D_{cb}		
<p>Given D_{is} and D_s, determine required length of D_{cb} to defeat threat. Maximum speed of Threat Vehicle in the serpentine (V_s) from above</p>			
V_s	V_s	40.3 f/s	
<p>V_i=maximum speed of threat vehicle at the ID Check Point to be able to decelerate to V_s at beginning of curve = $(V_s^2 + 2*a_d*D_{is})^{1/2}$</p>			
V_i	V_i	53.7 mph	78.8 f/s

Time for TV to travel from ID Check Point (point of detection) to the serpentine is $T_{is}=(V_i-V_s)/a_d$	T_{is}	1.6 sec
Distance thru serpentine: $D_s=s*(N-1)$	D_s	110 feet
Time to go thru serpentine = D_s/V_s	t_s	2.727 sec
Additional time required to delay Threat Vehicle for T_d seconds: $t_r = t - T_{is} - t_s$	t_r	4.7 sec
Additional straight line distance required to delay Threat Vehicle for t_r seconds: $D_{cb}=V_s*t_r+1/2*a*t_r^2$	D_{cb}	312 feet
Required distance between ID Check Point and the final barrier: $D_{ib}=D_{is}+D_s+D_{cb}$	D_{ib}	517 feet

Threat Scenario #3:
 In this Threat Scenario, The threat vehicle's initial speed at the point of detection (ID Check point) is $V_o=0$ mph, so this scenario is a less case than Threat Scenarios 1&2 above where V_i is much higher.

Threat Scenario #4:
 In this Threat Scenario, the threat vehicle is detected at the end of the last Turn-around traveling at the ACP speed limit ($V_o=25$ mph). Since the guards have identified this vehicle as a possible threat, guard reaction time is reduced from 3 to 1 seconds and the overall delay time is reduced from 9 to 7 seconds.

The time to go through the serpentine (t_s) plus the time to go from the end of the serpentine to the final barriers (t_r) is greater than the required time delay t , so Threat Scenario #4 is contained.

V_o	25 mph	36.7 f/s
t	7 sec	
t_s+t_r	7.4 sec	

Summary

Distance between ID Check Point and serpentine, $D_{is} =$	D_{is}	95 feet
Distance through serpentine, D_s	D_s	110 feet
Distance between end of Curve and barrier, $D_{cb} =$	D_{cb}	312 feet
Distance between ID Check Point and barrier, $D_{ib} =$	D_{ib}	517 feet

Notes:

1 In order to reduce D_{cb} , the serpentine can be extended with additional barriers. See

2 A serpentine requires a two lane roadway to develop. The serpentine essentially reduces the two lane roadway to one lane. Designers must consider the effect of using serpentines on traffic volumes through the ACP.

Attachment 19

Example - Serpentine throughout the Response Zone, Signs and Signals Safety System No Overspeed Detection

Parameters of the ACP:			
Serpentine in Response Zone with spacing between barriers of $s =$	s	55 feet	
Determine $N =$ the required number of barriers in the serpentine. Note, the minimum number of barriers to make a serpentine is 3.	N	?	
Roadway Width is $RW =$	RW	26 feet	
From Figure 9, the spinout speed in a Serpentine with s spacing between barriers is $V_s = s/2$	V_s	40.3 f/s	27.5 mph
Signs and Signals Safety System where required delay time =	t	9 sec	
Acceleration of Threat Vehicle: $a =$	a	11.3 f/s/s	
Deceleration of Threat Vehicle: $a_d =$	a_d	24.1 f/s/s	
Distance from ID Check Point to end of last Turn-around: D_{it}	D_{it}	90 feet	
Distance from ID Check Area to serpentine is $D_{is} =$	D_{is}	100 feet	

Threat Scenarios #1 and #2:			
For the high speed threat scenarios (TS #1) with no advanced overspeed detection, the point of detection is the ID Check Point.			
Path of the vehicle from the point of detection is as follows:			
ID Check Point to beginning of the serpentine:	D_{is}	D_{is}	
Distance through serpentine: D_s	D_s	D_s	
End of curve to final barriers: D_{cb}	D_{cb}	D_{cb}	
Given D_{ic} and D_s , determine required length of D_{cb} to defeat threat.			
Maximum speed of Threat Vehicle in the serpentine (V_s) from above	V_s	40.3 f/s	
$V_i =$ maximum speed of threat vehicle at the ID Check Point to be able to decelerate to V_c at beginning of curve = $(V_s^2 + 2 * a_d * D_{is})^{1/2}$	V_i	54.7 mph	80.3 f/s
Time for TV to travel from ID Check Point (point of detection) to the serpentine is $T_{is} = (V_i - V_s) / a_d$	T_{is}	1.66 sec	
Determine additional delay time required, $t_a = t - T_{is}$	t_a	7.34 sec	

Determine the approximate length of the serpentine required to get t_a seconds of delay, $D_a = V_s * t_a$	D_a	296 feet
Determine the number of barriers required in the serpentine, $N' = Da/s + 1$	N'	6.4
Use $N =$	N	6
Determine actual length of serpentine, $D_s = (N - 1) * s$	D_s	275 feet
Time for TV to travel through serpentine is $t_s = D_s / V_s$	t_s	6.82 sec
Additional straight line distance between the last serpentine barrier and the final active barrier must a minimum of s feet. $D_{sb} =$	D_{sb}	55 feet
Time for TV to travel distance D_{sb} is $T_{sb} = (-V_s + (V_s^2 + 2 * a * D_{sb})^{1/2}) / a$	T_{sb}	1.17 sec
Total time delay is $T_d = T_{is} + t_s + T_{sb}$	T_d	10.2 sec

Threat Scenario #3:

In this Threat Scenario, The threat vehicle's initial speed at the point of detection (ID Check point) is $V_o = 0$ mph, so this scenario is a less case than Threat Scenarios 1&2 above where V_i is much higher.

Threat Scenario #4:

In this Threat Scenario, the threat vehicle is detected at the end of the last Turn-around traveling at the ACP speed limit ($V_o = 25$ mph).

V_o 25 mph 0 f/s

Since the guards have identified this vehicle as a possible threat, guard reaction time is reduced from 3 to 1 seconds and the overall delay time is reduced from 9 to 7 seconds.

t 7 sec

The time delay through the Serpentine is $t_s =$

t_s 6.82 sec

Time from last serpentine barrier to final active barrier, $T_{sb} =$

T_{sb} 1.17 sec

Since $t_s + T_{sb} >$ than the required time delay of 7 seconds, TS#4 will be contained by the serpentine calculated for TS's 1&2 above.

Summary		
Distance between ID Check Point and Serpentine, $D_{is} =$	D_{is}	100 feet
Number of passive barriers in the Serpentine is $N =$	N	6
Distance through serpentine is $D_s =$	D_s	275 feet
Distance from last serpentine barrier to final active barrier is D_{sb}	D_{sb}	55 feet
Distance from ID Check Point to final barriers is $D_{ib} = D_{is} + D_s + D_{sb}$	D_{ib}	430 feet

APPENDIX E

COST ESTIMATES

Note: Costs reflect Contract Cost, mid point of construction Sep 2009, and area cost factor of 1.0

ACP Parameters - Estimate below is based on Dwg C3.02 of the Army ACP Standard Design/Criteria. See the Standard Design/Criteria for complete design requirements and procedures. The approach zone and response zone distances are based on two point over speed detectors and 2 zones of continuous over speed detection.

ACP Corridor - Length = Dacp	1,650 feet		
		Pavement	
Approach Zone (AZ)- feet	690 feet	Width in feet -	48
		Pavement	
Access Control Zone (ACZ) - feet	165 feet	Width in feet -	48
		Pavement	
Response Zone (RZ) - feet	795 feet	Width in feet -	48
Median between inbound & outbound lanes varies from 24' to 8' near final barriers.			
Roadway Perimeter = 4*(AZ+ACZ+RZ)	6,600 feet		
Roadway Area = (AZ+ACZ+RZ)*Width	79,200 sq-ft		
Number of Inbound Lanes	2		
Number of Outbound Lanes	2		

One Gatehouse, two Guard Booths, and one Pedestrian Guard Booth per Dwgs A1.05 and A1.09.

One Visitors Control Center per Dwg A1.01 (3 processor)

Parking Area - (140'*66')	9,300 sq-ft
Parking Perimeter = 2*(140'+66')	412 feet

One Search Building per Dwg A1.07.

VCC & Search Area Roads -	220 feet	12 Width - feet
Area -	2,640 sq-ft	
Perimeter -	440 feet	

Active Vehicle Barriers (AVB) 4 ea

Point Speed Detection in Inbound and Outbound Lanes at 1650 feet in front of AVBs.

Two zone Continuous Speed Detection on both Inbound Lanes in Approach & Access Control Zones.

Wrong-way Detection at two locations in both Outbound Lanes.

Description	Quantity	Unit	Per Unit Price	Total Price	
Buildings					
Gatehouse - 50'-4"x16'-8" See Dwg A1.05	840	sq-ft	\$428.18	\$359,670	
Guard Booth - Prefab, See Dwg A1.09	2	ea	\$50,000.00	\$100,000	
Guard Booth Pedestrian - See Dwg A1.09	1	ea	\$70,000.00	\$70,000	
Overwatch Position - See Dwg A1.09	1	ea	\$50,000.00	\$50,000	
Visitors Control Center 3 processor - 40' x 62', See Dwg A1.01	2,480	sq-ft	\$273.74	\$678,878	Note 8
Visitors Control Center 3 processor - 40' x 62', hardened for 50' standoff.	2,480	sq-ft	\$293.89		Note 8
Visitors Control Center 6 processor - 40' x 74', See Dwg A1.03	2,960	sq-ft	\$260.65		Note 8
Visitors Control Center 6 processor - 40' x 74', hardened for 50' standoff.	2,960	sq-ft	\$280.65		Note 8
Search Building with Pkg Scanner & Metal Detector - 30'x40', See Dwg A1.07	1,200	sq-ft	\$304.00	\$364,800	Note 1
Search Building w/o Pkg Scanner & Metal Detector - 25'x26', See Dwg A1.08	650	sq ft	\$304.00		Note 1
I.D. Check Area Canopy - 64'x69', See Dwg A1.10	4,416	sq-ft	\$100.26	\$442,738	

	Search Area Canopy - Passenger Vehicles - 24'x60', See Dwg A1.11	1,440	sq-ft	\$89.04	\$128,212		
	Search Area Canopy - Trucks - 26'x80', See Dwg A1.11	2,080	sq-ft	\$80.11	\$166,639		
Equipment							
	Active Vehicle Barrier w EFO - NO Operation	4	ea	\$79,000.00	\$316,000	Note 2	
	Active Vehicle Barrier w/o EFO - NC Operation			\$73,500.00		Note 3	
	Crash Beam Barrier w EFO - NO Operation			\$63,000.00		Note 2	
	Crash Beam Barrier w/o EFO - NC Operation			\$52,500.00		Note 3	
	Active Vehicle Barrier Control System (AVBCS) - includes Traffic Controller Unit, Barrier Control Panels, Vehicle presence detectors, & UPS	1	ea	\$70k + \$10k * Barrier + \$10k * Guard Booth	\$110,000.00		
	Traffic signals	1	lump sum	\$70,000.00	\$70,000.00	Note 4	
	Electronic Security System (ESS) - includes PLC/CPU, GH Control Console, Alarm Panels, IDS, Duress, Tamper, & Event Recorder	1	ea	\$53k+\$5k * Barrier+5k*gua rd booths & overwatch	\$93,000.00	Note 7	
	CCTV	1	ea	\$120,000.00	\$120,000		
	Point Overspeed Detection in both Inbound and Outbound Lanes			\$5k+\$3K * (Lin + Lout)	\$17,000.00		
	Wrong-way Detection in 2 locations (loc) on Outbound Lanes	2	loc	\$5k+\$3K * loc * Lout	\$17,000.00		
	Continuous Overspeed Detection - One Zone			\$10k+\$10k*Lin	\$30,000.00	Note 5	
	Continuous Overspeed Detection - Two Zones			\$10k+\$21k*Lin		Note 5	
	Crash Beam Barrier w Rem Controls (Corridor)	0	ea	\$63,000.00	\$0	Note 6	
	Fence Gate - non-crash rated (per leaf)	4	ea	\$1,800.00	\$7,200		
	Traffic Arms	2	ea	\$8,400.00	\$16,800		
	Diesel Generator & Swgr	1	ea	\$83,263.00	\$83,263		
Sitework							
	FE 6 fence	0	lf	\$50.00	\$0		
	Passive cable barriers along corridor (K4 rated triple cable system) and FE-6 fence (Length is 2*Dacp + extra length around search area - length of higher capacity barriers.)	2,400	lf	\$175.00	\$420,000		
	Passive Barriers along Corridor (K8 vehicle rated fence w/dual cables)	800	lf	\$228.00	\$182,400		
	FE6 fence with 2 each 3/4" cables with deadmen (based on 200 foot spacing between deadmen)	0	lf	\$158.00	\$0		
	K12 concrete barrier w/FE 6 fence	0	lf	\$608.00	\$0		
	K12 cable vehicle barrier system w/FE 6 fence	0	lf	\$350.00	\$0		
	Elec Power, conduit, and communications	1	lot	\$139,125.00	\$139,125		
	Exterior Lighting along Roadway Perimeters	2,502	lf	\$95.00	\$237,690		
	Barrier Overwatch Pad & Jct Box	0	ea	\$5,600.00	\$0		
	Guard Booth Crash Barrier	2	ea	\$4,860.00	\$9,720		
	Landscaping	1	ls	\$5,570.00	\$5,570		
	Obscuration screening	90	lf	\$34.00	\$3,060		
Roadwork							
	Pavement - Roadways in AZ+ACZ+RZ	79,200	sq-ft	\$18.00	\$1,425,600		
	Pavement - VCC Parking Area	9,300	sq-ft	\$18.00	\$167,400		
	Pavement - VCC & Search Area Roadways	2,640	sq-ft	\$18.00	\$47,520		

	Curb and gutter - (Roadway & Parking Perimeters)	7,452	lf	\$28.00	\$208,656		
	Pavement - 4' wide sidewalk (lf)	1,650	lf	\$13.00	\$21,450		
	Signs & Pavement Markings (ls)			\$3.5k + \$2.5k * (Lin+Lout)	\$13,500		
	Raised Island for Guard Booth	1	ea	\$5,570.00	\$5,570		
				Total Cost	\$6,128,460		

Notes:

- 1 Select appropriate type of search building; typically there is only one search building per ACP.
- 2 Active Barrier for normally open operation, e.g., SDDC's Signs and Signals or Presence Detection Safety Systems. Capable of blocking one traffic lane.
- 3 Active Barrier for normally closed operation, e.g., SDDC's Normally Closed Safety System. Capable of blocking one traffic lane.
- 4 Traffic signals based on 4 lanes, no intersection (as shown on dwg C3.02). Two poles w/arms and three signal heads each (two on the arms and one on each pole). The controller cost is included with the AVB control system.
- 5 Select no, one, or two zones of continuous overspeed detection.
- 6 Corridor barriers are remotely operated from Gatehouse and do not have an EFO mode. They can be used for access to limited use areas from the ACP corridor (e.g., utility access roadway).
- 7 When interfacing ACP alarms with the Installation's Central Security Monitoring System, include interface costs only and eliminate cost for a separate ESS PLC/CPU.
- 8 If required, select appropriate size of VCC and VCC parking area based on expected visitor requirements.

APPENDIX F

ELECTRICAL LOADS

APPENDIX F

ELECTRICAL DATA

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
APPROACH ZONE	UPPER APPROACH ZONE LIGHTING FIXTURE	22.a	YES	YES		4	460	1,840	YES	1,840
APPROACH ZONE	UPPER APPROACH ZONE LIGHTING FIXTURE	22.a	YES	YES		10	288	2,880	YES	2,880
APPROACH ZONE	UPPER APPROACH ZONE SPEED DETECTION	28.g.4	YES	YES	YES	1	1,200	1,200	YES	1,200
APPROACH ZONE	UPPER APPROACH ZONE WRONG WAY DETECTION	28.g.4	YES	YES	YES	1	1,200	1,200	YES	1,200
SECONDARY ISLAND			YES	YES	YES	1	1,200	1,200	YES	1,200
SECONDARY ISLAND	OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
SECONDARY ISLAND	LANE-2 LEFT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
SECONDARY ISLAND	LANE-3 LEFT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
SECONDARY ISLAND	LANE-4 LEFT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
SECONDARY ISLAND	OVERHEIGHT DETECTION	29.d	YES	YES		1	240	240	YES	240
ACCESS CONTROL ZONE	CAMERA - LANE 1 DRIVER, VEHICLE, AND GUARD	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 1 LICENSE	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 2 DRIVER, VEHICLE, AND GUARD	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 2 LICENSE	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 3 DRIVER, VEHICLE, AND GUARD	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 3 LICENSE	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 4 DRIVER, VEHICLE, AND GUARD	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - LANE 4 LICENSE	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - PEDESTRIAN AND GUARD	K9	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	CAMERA - UPPER APPROACH ZONE	23	YES	YES	YES	1	70	70	YES	70
ACCESS CONTROL ZONE	GUARD BOOTH-1 COMPUTER	25	YES	YES	YES	1	816	816	YES	816
ACCESS CONTROL ZONE	GUARD BOOTH-1 EXTERIOR RECEPTACLE	14.c	YES	YES		2	600	1,200		0
ACCESS CONTROL ZONE	GUARD BOOTH-1 GENERAL RECEPTACLE	14.d	YES	YES		2	180	360		0
ACCESS CONTROL ZONE	GUARD BOOTH-1 HVAC	14.b	YES	YES		1	93	93	YES	93

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
ACCESS CONTROL ZONE	GUARD BOOTH-1 INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240
ACCESS CONTROL ZONE	GUARD BOOTH-1 LIGHTING FIXTURE	14	YES	YES		1	73.6	74	YES	74
ACCESS CONTROL ZONE	GUARD BOOTH-2 COMPUTER	25	YES	YES	YES	1	816	816	YES	816
ACCESS CONTROL ZONE	GUARD BOOTH-2 EXTERIOR RECEPTACLE	14.c	YES	YES		2	600	1,200		0
ACCESS CONTROL ZONE	GUARD BOOTH-2 GENERAL RECEPTACLE	14.d	YES	YES		2	180	360		0
ACCESS CONTROL ZONE	GUARD BOOTH-2 HVAC	14.b	YES	YES		1	93	93	YES	93
ACCESS CONTROL ZONE	GUARD BOOTH-2 INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240
ACCESS CONTROL ZONE	GUARD BOOTH-2 LIGHTING FIXTURE	14	YES	YES		1	73.6	74	YES	74
ACCESS CONTROL ZONE	GUARD BOOTH-3 COMPUTER	25	YES	YES	YES	1	816	816	YES	816
ACCESS CONTROL ZONE	GUARD BOOTH-3 EXTERIOR RECEPTACLE	14.c	YES	YES		2	600	1,200		0
ACCESS CONTROL ZONE	GUARD BOOTH-3 GENERAL RECEPTACLE	14.d	YES	YES		2	180	360		0
ACCESS CONTROL ZONE	GUARD BOOTH-3 HVAC	14.b	YES	YES		1	93	93	YES	93
ACCESS CONTROL ZONE	GUARD BOOTH-3 INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240
ACCESS CONTROL ZONE	GUARD BOOTH-3 LIGHTING FIXTURE	14	YES	YES		1	73.6	74	YES	74
ACCESS CONTROL ZONE	GUARD BOOTH-4 COMPUTER	25	YES	YES	YES	1	816	816	YES	816
ACCESS CONTROL ZONE	GUARD BOOTH-4 EXTERIOR RECEPTACLE	14.c	YES	YES		2	600	1,200		0
ACCESS CONTROL ZONE	GUARD BOOTH-4 GENERAL RECEPTACLE	14.d	YES	YES		2	180	360		0
ACCESS CONTROL ZONE	GUARD BOOTH-4 HVAC	14.b	YES	YES		1	93	93	YES	93
ACCESS CONTROL ZONE	GUARD BOOTH-4 INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240
ACCESS CONTROL ZONE	GUARD BOOTH-4 LIGHTING FIXTURE	14	YES	YES		1	73.6	74	YES	74
ACCESS CONTROL ZONE	ID CHECK AREA CANOPY LIGHTING FIXTURE	22b	YES	YES		22	250	5,500	YES	5,500
ACCESS CONTROL ZONE	LANE-1 RIGHT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
ACCESS CONTROL ZONE	LANE-1 TRAFFIC ARM	29.a	YES	YES	YES	1	760	760		0
ACCESS CONTROL ZONE	LANE-2 RIGHT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
ACCESS CONTROL ZONE	LANE-2 TRAFFIC ARM	29.a	YES	YES	YES	1	760	760		0
ACCESS CONTROL ZONE	LANE-3 RIGHT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0
ACCESS CONTROL ZONE	LANE-3 TRAFFIC ARM	29.a	YES	YES	YES	1	760	760		0
ACCESS CONTROL ZONE	LANE-4 RIGHT OVERHEIGHT SIGN	29.d	YES	YES		1	1,200	1,200		0

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
ACCESS CONTROL ZONE	LANE-4 TRAFFIC ARM	29.a	YES	YES	YES	1	760	760		0
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH COMPUTER	25	YES	YES	YES	1	816	816	YES	816
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH EXTERIOR RECEPTACLE	14.c	YES	YES		2	600	1,200		0
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH GENERAL RECEPTACLE	14.d	YES	YES		2	180	360		0
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH HVAC	14.b	YES	YES		1	541	541	YES	541
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240
ACCESS CONTROL ZONE	PEDESTRIAN GUARD BOOTH LIGHTING FIXTURE	14	YES	YES		3	73.6	221	YES	221
ACCESS CONTROL ZONE	UPPER ACCESS CONTROL ZONE LIGHTING FIXTURES	22.b	YES	YES		7	460	3,220	YES	3,220
ACCESS CONTROL ZONE	UPPER ACCESS CONTROL ZONE LIGHTING FIXTURES	22.b	YES	YES		3	288	864	YES	864
GATEHOUSE	ACTIVE BARRIER CONTROL PANEL	20.f	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	CAMERA - ID CHECK AREA	23.b	YES	YES	YES	1	70	70	YES	70
GATEHOUSE	GATEHOUSE CCTV DIGITAL VIDEO RECORDER	23.e&f	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE CCTV MONITOR	23.e&f	YES	YES	YES	2	216	432	YES	432
GATEHOUSE	GATEHOUSE CCTV MULTIPLEXER	23.e&f	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE CCTV SWITCH	23.e&f	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE COMPUTER	25	YES	YES	YES	1	816	816	YES	816
GATEHOUSE	GATEHOUSE COMPUTER	25	YES	YES	YES	1	816	816	YES	816
GATEHOUSE	GATEHOUSE DURESS CONTROL PANEL	20.f	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE EXTERIOR RECEPTACLES	13.g	YES	YES		1	600	600		0
GATEHOUSE	GATEHOUSE EXTERIOR RECEPTACLES	13.g	YES	YES		1	600	600		0
GATEHOUSE	GATEHOUSE EXTERIOR RECEPTACLES	13.g	YES	YES		1	600	600		0
GATEHOUSE	GATEHOUSE EXTERIOR RECEPTACLES	13.g	YES	YES		1	600	600		0
GATEHOUSE	GATEHOUSE GENERAL RECEPTACLES	13.h	YES	YES		3	180	540		0
GATEHOUSE	GATEHOUSE GENERAL RECEPTACLES	13.h	YES	YES		3	180	540		0

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
GATEHOUSE	GATEHOUSE HAND DRYER		YES	YES		1	1,200	1,200	YES	1,200
GATEHOUSE	GATEHOUSE HVAC	13.b	YES	YES		1	2,400	2,400	YES	2,400
GATEHOUSE	GATEHOUSE INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE LIGHTING FIXTURE	13	YES	YES		11	73.6	810	YES	810
GATEHOUSE	GATEHOUSE EXTERIOR LIGHTING	13	YES	YES		1	300	300	YES	300
GATEHOUSE	GATEHOUSE FIRE ALARM PANEL		YES	YES		1	400	400	YES	400
GATEHOUSE	GATEHOUSE OVERHEIGHT CONTROL PANEL	29	YES	YES		1	600	600	YES	600
GATEHOUSE	GATEHOUSE SPEED CONTROL PANEL		YES	YES	YES	1	600	600	YES	600
GATEHOUSE	GATEHOUSE WATER COOLER	13.c	YES	YES		1	325	325	YES	325
GATEHOUSE	GATEHOUSE WRONG WAY CONTROL PANEL		YES	YES	YES	1	600	600	YES	600
EMER GENERATOR	EMER GEN LUBE & COOLANT HEATERS		YES	YES		2	500	1,000	YES	1,000
RESPONSE ZONE AND FINAL BARRIER	ACTIVE BARRIER-1	20.a	YES	YES	YES	1	3,640	3,640		0
RESPONSE ZONE AND FINAL BARRIER	ACTIVE BARRIER-2	20.a	YES	YES	YES	1	3,640	3,640		0
RESPONSE ZONE AND FINAL BARRIER	ACTIVE BARRIER-3	20.a	YES	YES	YES	1	3,640	3,640		0
RESPONSE ZONE AND FINAL BARRIER	ACTIVE BARRIER-4	20.a	YES	YES	YES	1	3,640	3,640		0
RESPONSE ZONE AND FINAL BARRIER	AVB CONTROL UNIT HEATERS		YES	YES		2	2,000	4,000	YES	4,000
RESPONSE ZONE AND FINAL BARRIER	CAMERA - ACTIVE BARRIERS AND OVERWATCH	23.a	YES	YES	YES	1	70	70	YES	70
RESPONSE ZONE AND FINAL BARRIER	UPPER RESPONSE ZONE AND BARRIER LIGHTING FIXTURE	22.a	YES	YES		5	460	2,300	YES	2,300
RESPONSE ZONE AND FINAL BARRIER	UPPER RESPONSE ZONE AND BARRIER LIGHTING FIXTURE	22.a	YES	YES		6	288	1,728	YES	1,728
RESPONSE ZONE AND FINAL BARRIER	UPPER RESPONSE ZONE SIGN	20.f	YES	YES	YES	2	1200	2,400		0
RESPONSE ZONE AND FINAL BARRIER	UPPER RESPONSE ZONE TRAFFIC ARM	29.a	YES	YES	YES	2	760	1,520		0
OVERWATCH POSITION	OVERWATCH BUILDING COMPUTER	25	YES	YES	YES	1	816	816	YES	816
OVERWATCH POSITION	OVERWATCH BUILDING GENERAL RECEPTACLES	18.a.3	YES	YES		4	180	720		0
OVERWATCH POSITION	OVERWATCH BUILDING HVAC	18.a.2	YES	YES		1	434	434	YES	434
OVERWATCH POSITION	OVERWATCH BUILDING INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	240	240	YES	240

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
OVERWATCH POSITION	OVERWATCH BUILDING LIGHTING FIXTURE	18	YES	YES		3	73.6	221	YES	221
VISITOR CONTROL CENTER	LIGHTING FIXTURE	21	YES	YES		3	288	864	YES	864
VISITOR CONTROL CENTER	LIGHTING FIXTURE	21	YES	YES		4	460	1,840	YES	1,840
VISITOR CONTROL CENTER	VCC COFFEE MAKER		YES	YES		1	1680	1,680	YES	1,680
VISITOR CONTROL CENTER	VCC COMPUTER	25	YES	YES	YES	1	816	816	YES	816
VISITOR CONTROL CENTER	VCC COMPUTER	25	YES	YES	YES	1	816	816	YES	816
VISITOR CONTROL CENTER	VCC COMPUTER	21.d	YES	YES	YES	1	816	816	YES	816
VISITOR CONTROL CENTER	VCC COMPUTER	21.d	YES	YES	YES	1	816	816	YES	816
VISITOR CONTROL CENTER	CAMERA - WAITING AREA		YES	YES	YES	2	70	140	YES	140
VISITOR CONTROL CENTER	CAMERA - PROCESSING AREA		YES	YES	YES	2	70	140	YES	140
VISITOR CONTROL CENTER	CAMERA - PARKING AREA		YES	YES	YES	2	70	140	YES	140
VISITOR CONTROL CENTER	VCC EXTERIOR RECEPTACLE	21	YES	YES		1	600	600		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC GENERAL RECEPTACLES	21	YES	YES		3	180	540		0
VISITOR CONTROL CENTER	VCC HAND DRYER		YES	YES		1	1,200	1,200		0
VISITOR CONTROL CENTER	VCC HAND DRYER		YES	YES		1	1,200	1,200		0
VISITOR CONTROL CENTER	VCC HAND DRYER		YES	YES		1	1,200	1,200		0
VISITOR CONTROL CENTER	VCC HVAC	21	YES	YES		1	4652	4,652	YES	4,652
VISITOR CONTROL CENTER	VCC INTRUSION DETECTION PANEL	26.b	YES	YES	YES	1	600	600	YES	600
VISITOR CONTROL CENTER	VCC LIGHTING FIXTURE		YES	YES		27	73.6	1,987	YES	1,987
VISITOR CONTROL CENTER	VCC MICROWAVE OVEN		YES	YES		1	1550	1,550		0
VISITOR CONTROL CENTER	VCC REFRIGERATOR		YES	YES		1	528	528	YES	528
VISITOR CONTROL CENTER	VCC WATER COOLER	21.g	YES	YES		1	325	325	YES	325

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
SEARCH AREA AND OFFICE	CAMERA - GUARD, DRIVER, AND VEHICLE OF POV SEARCH	23.a&c	YES	YES	YES	1	70	70	YES	70
SEARCH AREA AND OFFICE	CAMERA - SEARCH	23.a&c	YES	YES	YES	1	70	70	YES	70
SEARCH AREA AND OFFICE	LIGHTING FIXTURE	22.b	YES	YES		16	288	4,608	YES	4,608
SEARCH AREA AND OFFICE	LIGHTING FIXTURE	22.b	YES	YES		1	460	460	YES	460
SEARCH AREA AND OFFICE	POV SEARCH TRAFFIC ARM		YES	YES	YES	1	760	760		0
SEARCH AREA AND OFFICE	SEARCH AREA CANOPY LIGHTING FIXTURE	22.b	YES	YES		45	250	11,250	YES	11,250
SEARCH AREA AND OFFICE	SEARCH OFFICE ACCESS CONTROL CONTROL PANEL	22.b	YES	YES	YES	1	600	600	YES	600
SEARCH AREA AND OFFICE	SEARCH OFFICE COFFEE MAKER		YES	YES		1	1,680	1,680	YES	1,680
SEARCH AREA AND OFFICE	SEARCH OFFICE COMPUTER	17.m	YES	YES	YES	1	816	816	YES	816
SEARCH AREA AND OFFICE	SEARCH OFFICE COMPUTER	17.m	YES	YES	YES	1	816	816	YES	816
SEARCH AREA AND OFFICE	SEARCH OFFICE COMPUTER	17.m	YES	YES	YES	1	816	816	YES	816
SEARCH AREA AND OFFICE	SEARCH OFFICE COMPUTER	17.h	YES	YES	YES	1	816	816	YES	816
SEARCH AREA AND OFFICE	SEARCH OFFICE COMPUTER	17.h	YES	YES	YES	1	816	816	YES	816
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE GENERAL RECEPTACLES	17.i	YES	YES		3	180	540		0
SEARCH AREA AND OFFICE	SEARCH OFFICE HAND DRYER		YES	YES		1	1,200	1,200		0
SEARCH AREA AND OFFICE	SEARCH OFFICE HVAC	17.a	YES	YES		1	4,652	4,652	YES	4,652
SEARCH AREA AND OFFICE	SEARCH OFFICE LIGHTING FIXTURE	17	YES	YES		27	73.6	1,987	YES	1,987
SEARCH AREA AND OFFICE	SEARCH OFFICE METAL DETECTOR	17.k	YES	YES		1	600	600		0

LOCATION	DESCRIPTION	SECTION OF "ACP CRITERIA FROM OPMG"	UTILITY	EMER GEN	UPS	QTY	VOLT AMPS	Utility Connected	DEMAND	Utility Demand
SEARCH AREA AND OFFICE	SEARCH OFFICE MIRCOWAVE OVEN	17.g	YES	YES		1	1550	1,550		0
SEARCH AREA AND OFFICE	SEARCH OFFICE REFRIGERATOR	17.G	YES	YES		1	528	528	YES	528
SEARCH AREA AND OFFICE	SEARCH OFFICE TAMPER SWITCH CONTROL PANEL		YES	YES	YES	1	600	600	YES	600
SEARCH AREA AND OFFICE	SEARCH OFFICE WATER COOLER	17.g	YES	YES		1	325	325	YES	325
SEARCH AREA AND OFFICE	SEARCH OFFICE X RAY	17.K	YES	YES		1	600	600		0
COMMERCIAL VEHICLE SEARCH AREA	CAMERA - GUARD, DRIVER, & VEHICLE OF TRUCK SEARCH	23.a&c	YES	YES	YES	1	70	70	YES	70
COMMERCIAL VEHICLE SEARCH AREA	LIGHTING FIXTURE	22.b&c	YES	YES		9	288	2,592	YES	2,592
COMMERCIAL VEHICLE SEARCH AREA	LIGHTING FIXTURE	22.b&c	YES	YES		11	460	5,060	YES	5,060
COMMERCIAL VEHICLE SEARCH AREA	TRUCK SEARCH TRAFFIC ARM	29	YES	YES	YES	1	760	760		0
CARGO AND VEHICLE INSPECTION SYSTEM AREA	CARGO AND VEHICLE INSPECTION SYSTEM		YES			1	100,000	100,000	YES	100,000

Total 264,942 204,122

UTILITY/GENERATOR/UPS	TOTAL CONNECTED VA	TOTAL DEMAND VA
UTILITY	264,942	204,122
GENERATOR	164,942	104,122
UPS	50,454	27,414

Note: The above totals do not include spare capacity for future expansion.

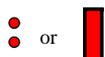
APPENDIX G

PRESENCE DETECTION SAFETY SCHEME

Symbols for Traffic Control Layouts

Note: Sheets show a typical 4-lane divided roadway on a straight section. Similar controls would exist for a two-lane, two-way roadway. In the 4-lane divided examples, median and shoulder guardrail or longitudinal barriers are assumed to be in place (not shown). The primary objective is to show traffic control devices on a conceptual layout.

In all situations, lane barrier curbs exist instead of pavement markings shown. The detailed sheet shows a 3 lane inbound roadway with the barrier islands. Roadway islands need to separate lanes for security, control, barrier signal operations, and placement of signs, signals, and beam sensors. Under roadway drainage must be designed with the roadway islands.

-  — Symbol for barrier to deploy up from lane or across roadway.

-  — Red In-Roadway Lights that flash red when barrier is activated. For use when barriers do not contain lights at activation.

-  — Red zone quadrupole inductive loop detector (6' X L'), with L being 6 feet beyond Stop line to 4 feet in advance of active barrier that provides input to the lane barrier signal operation.

-  — Queue quadrupole loop detector (6' X 20') about 80 feet inbound from checkpoint to provide lane barrier signal preemption capability for a preset time to clear the pocket of secured vehicles between the queue loop detector and signal Stop line.

-  — One or more induction loop detectors that provide input to the microprocessor controller for lane barrier signal operations for the following functions: (1) One or more loops extending back from Stop line that detect presence of vehicles at or near Stop line, and (2) loop that provides input confirmation that vehicle has cleared the active barrier.

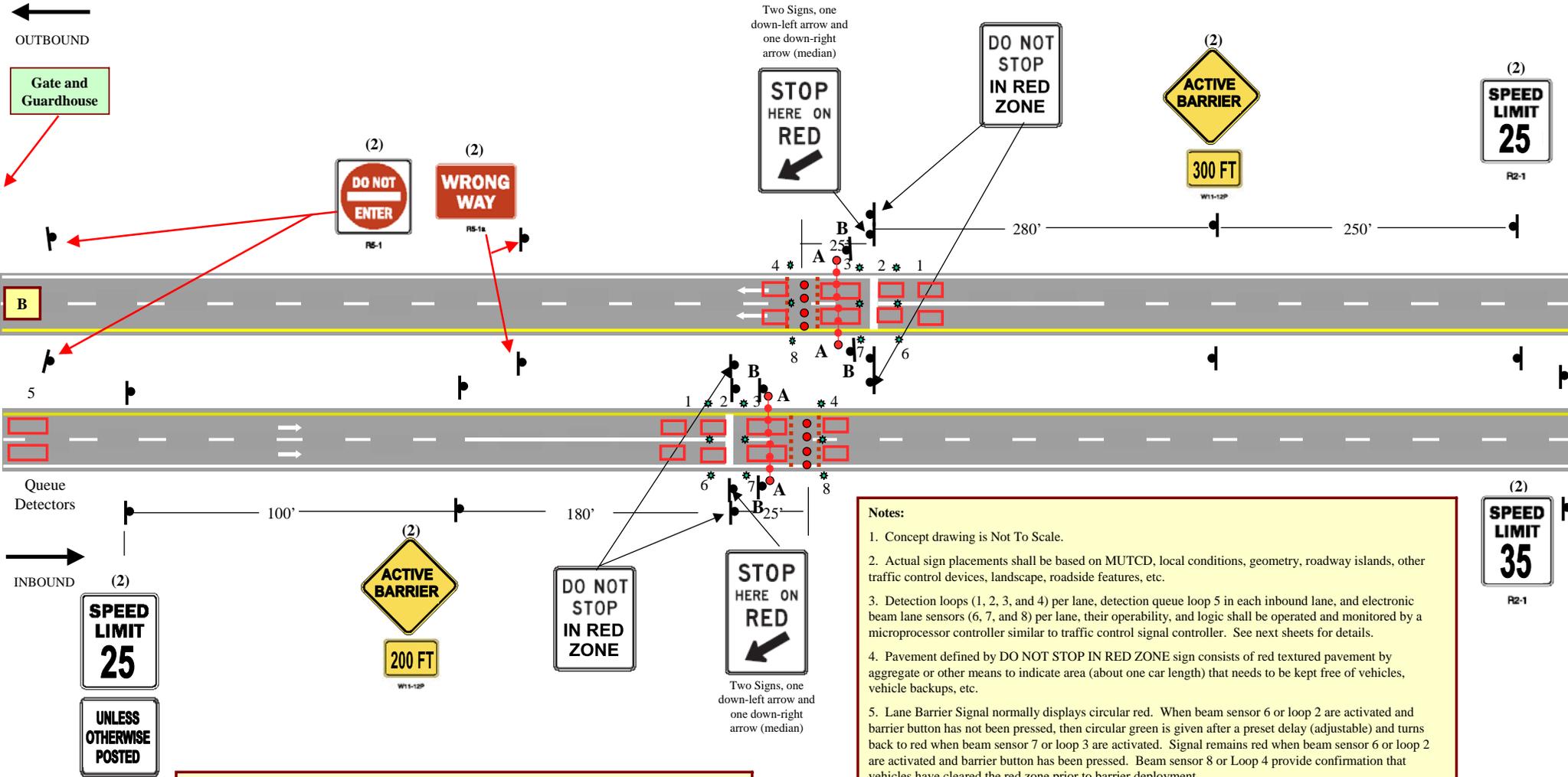
-  — Post mounted sign on shoulder, lane island, or in median.

-  — Traffic Gate Arm in the down horizontal position with flashing red lights when barrier deployment command has been initiated by guard pressing a button or by other automated means.

-  — Electronic beam lane sensors that provide input to the lane barrier signal operation for low metal-mass vehicles such as scooters, motorcycles, mopeds and bicycles.



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)



B – Logic, Video, and other Detection methods and alarms are available to detect a vehicle traveling the wrong direction (in on out-bound side) with automatic traffic control devices response such as vertically aligned, red beacons (not shown above) start alternating flash on the DO NOT ENTER and WRONG WAY signs prior to outbound barriers being fully deployed from guard response.

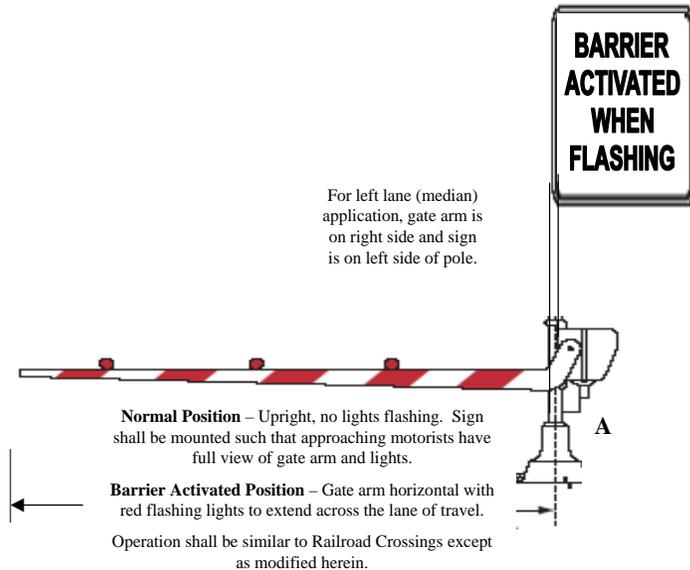
- Notes:**
1. Concept drawing is Not To Scale.
 2. Actual sign placements shall be based on MUTCD, local conditions, geometry, roadway islands, other traffic control devices, landscape, roadside features, etc.
 3. Detection loops (1, 2, 3, and 4) per lane, detection queue loop 5 in each inbound lane, and electronic beam lane sensors (6, 7, and 8) per lane, their operability, and logic shall be operated and monitored by a microprocessor controller similar to traffic control signal controller. See next sheets for details.
 4. Pavement defined by DO NOT STOP IN RED ZONE sign consists of red textured pavement by aggregate or other means to indicate area (about one car length) that needs to be kept free of vehicles, vehicle backups, etc.
 5. Lane Barrier Signal normally displays circular red. When beam sensor 6 or loop 2 are activated and barrier button has not been pressed, then circular green is given after a preset delay (adjustable) and turns back to red when beam sensor 7 or loop 3 are activated. Signal remains red when beam sensor 6 or loop 2 are activated and barrier button has been pressed. Beam sensor 8 or Loop 4 provide confirmation that vehicles have cleared the red zone prior to barrier deployment.
 6. Detection loop 5 shall preempt the microprocessor controller for a preset time (adjustable) after it detects vehicle presence for 15 seconds (adjustable). The preset preemption time is the time required to clear the number of guard approved vehicles stopped between the Stop line and Queue loop detector 5.



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)

Basic Layout Operation:

1. Road users warned of **ACTIVE BARRIER** and distance (Advance Warning Sign).
2. Motorists come to complete stop at the **Lane Barrier Signal** that normally displays a circular red at 24" Thermoplastic Stop Line. Military Police shall periodically monitor motorists compliance with the lane barrier signal and stopping at Stop line on the circular red and prior to red zone. Red zone is red textured pavement or other acceptable means.
3. Motorists told **ONE VEHICLE PER GREEN** (Regulatory Sign below **Lane Barrier Signal**). If barrier button has not been pressed, the green signal is given when detection loops 1 or 2 detect presence for 2 seconds (adjustable) or lane sensor number 6 beam has been broken (with adjustable delay). Lane control signal reverts back to normally red after loop 3 is activated or after beam sensor 7 is broken. All times shall be adjustable.
4. Steady green LED lights at the guardhouse shall indicate the satisfactory operation of each individual loop detector and beam sensor. Similarly, LED light(s) shall flash red for the specific loop or beam sensor that fails or is offline with the microprocessor controller. The lane barrier signal operation shall safeguard innocent road users at the active barriers.
5. Upon guard activation of lane barrier, lane control signal shall "hold" circular red. Traffic Gate Arm is flashed and lowered after delay. Active barriers shall not deploy until after loops 3 and 4 are cleared of vehicles and after beam sensors 8 has cleared following an adjustable delay after beam sensor 7 activation. See beam sensor and loop table.
6. Use red color pavement (aggregate instead of paint) from 2 feet forward of the Stop line to 10 feet beyond the pop-up barrier. Install **DO NOT STOP IN RED ZONE** Sign (Regulatory).
7. The following controls prevent vehicles extending into red zone: (1) Normally **Red Lane Barrier Signal**, (2) Stop Line, (3) **DO NOT STOP IN RED ZONE**, and (4) Traffic Gate Arm location.



3-Section Programmed Visibility Signals to the applicable lane



B

Static Signs – Signs below signal shall be black legend on white background.



3-Section Programmed Visibility Signals to the applicable lane



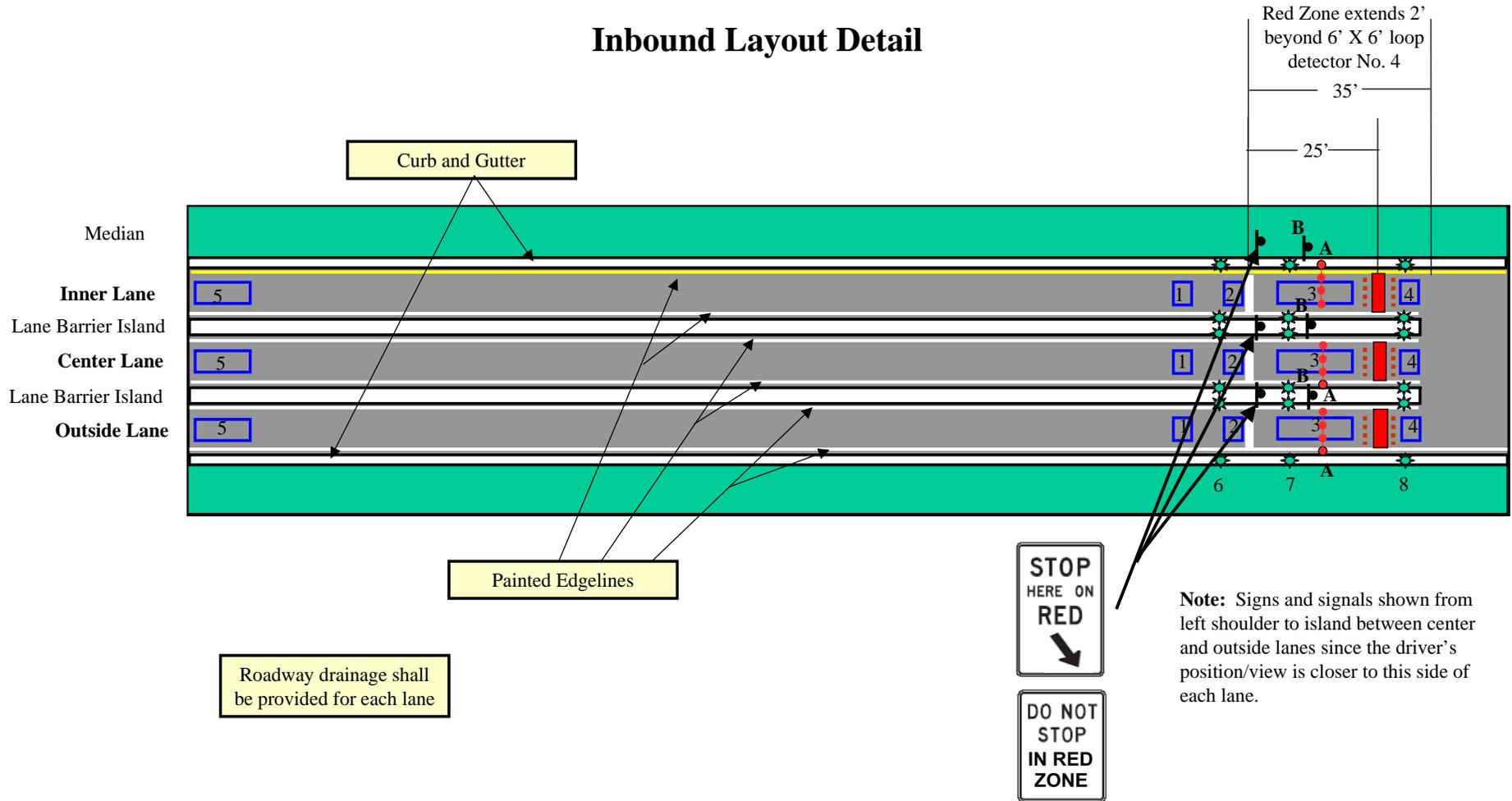
B

Electronic Blank-out Signs – If electronic blank-out signs are used, then legend shall be white on a black or opaque background. The ONE VEHICLE PER GREEN sign shall illuminate message only when the circular red and green operate in the "metering for security" mode. If blank-out, the PROCEED WITH CAUTION ON FLASHING YELLOW sign shall be modified to PROCEED WITH CAUTION. The latter message shall illuminate only when the circular yellow is flashing. Circular yellow is used for (1) Queue Preemption to clear approved vehicles in a backup, (2) system start-up, (3) low-threat conditions, and (4) other situations per the Commanding Officer.



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)

Inbound Layout Detail



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)

Barrier Activated Regardless of Reason T=0	Signal Color Time After Activation, T = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	SAFETY CONTROLS (separately for each lane)							Barrier Status
		Vehicle Presence on Loop (L) or Beam Sensor Broken (BB)			Automatic Gate		Barrier Lights		
		L - 1 & 2 or BB - 6	L - 3 or BB - 7	L - 4 or BB - 8	Lights	Arm	Pavement or Barrier	Post Mounted	
	Normal State	-	-	-	Dark	Upright	Dark	Dark	Down
X	Red (hold), 0	N	N	N	FR	Start Down	FR	R	Start Up
	Red (hold), 1	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 2	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 3	Y or N	N	N	FR	Down	FR	R	Up
X	Red (hold), 0	N	N	Y	FR	Upright	FR	R	Down
	Red (hold), 1	Y or N	N	N	FR	Start Down	FR	R	Start Up
	Red (hold), 2	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 3	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 4	Y or N	N	N	FR	Down	FR	R	UP
X	Red (hold), 0	N	Y	Y	FR	Upright	Dark	Dark	Down
	Red (hold), 1	Y or N	N	Y	FR	Upright	FR	R	Down
	Red (hold), 2	Y or N	N	N	FR	Start Down	FR	R	Start Up
	Red (hold), 3	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 4	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 5	Y or N	N	N	FR	Down	FR	R	Up
X	Red (hold), 0	Y	Y	Y or N	Dark	Upright	Dark	Dark	Down
	Red (hold), 1	Y or N	Y	Y or N	Dark	Upright	Dark	Dark	Down
	Red (hold), 2	Y or N	Y or N	Y	FR	Upright	Dark	Dark	Down
	Red (hold), 3	Y or N	N	Y	FR	Upright	FR	R	Down
	Red (hold), 4	Y or N	N	N	FR	Start Down	FR	R	Start Up
	Red (hold), 5	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 6	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 7	Y or N	N	N	FR	Down	FR	R	Up

Loop Detector and Signal Operation:

- Loops 1, 2, 3, 4, and 5 shall operate in the presence mode. Loop No. 5 operates as a queue detector.
- Barrier Close Suppression Logic – When guards initiate a barrier “Emergency Fast Operate” command to close the barriers, each barrier’s “close” circuit will be suppressed until the Lane Control Signal in that barrier’s lane is circular red and loop detectors 3 and 4 and break beam sensors 7 and 8 in that barrier’s lane do not detect a vehicle. In the case of break beam 7, the logic will include an adjustable time delay after break beam 7 drops out to hold the suppression circuit for the time delay. This time delay will allow a small vehicle (e.g., a bicycle), which may not have been detected by the loops, to proceed safely beyond the barrier if the barrier “Emergency Fast Operate” command was initiated right after the bicycle passed break beam 7. See “Loop Detection and Beam Sensor Priority Control During Preemption” table next sheet.
- The microprocessor controller shall meet NEMA standards for timing, preemption, and detector capabilities. The basic operation is lane metering for threat response of each lane separately (having barrier island) with two preemption capabilities:
 - Normal Operation – Normal operation is circular red signal in each lane with a circular green given after an adjustable delay on loops 1 and 2 (typically just enough for the vehicle to come to a complete stop) or beam sensor 6 is broken. The signal reverts back to red when loop 3 detects presence or beam sensor 7 is broken.
 - Barrier Deployment Preemption – Barrier deployment preemption is initiated by gatehouse or checkpoint guards pressing a button. Lane barrier signals are preempted for lane barrier deployment according to the logic shown in the table.
 - Queue Preemption during Peak Demand Periods – Queue detector preemption is initiated after loop 5 detects constant presence for a preset adjustable time (for example 15 seconds). Lane barrier signal shall go to flashing yellow for a preset time to clear vehicles between loop 5 and the Stop line. After the preset (adjustable) preemption time expires, the signal shall time 4 seconds of steady circular yellow before going to circular red, and then to standard lane barrier signal metering operation.
 - Barrier Deployment During Queue Preemption – If guards initiate the “Emergency Fast Operate” command during queue preemption, the lane control signal shall change from flashing “Yellow” to solid “Yellow” for 3 seconds and then to solid “Red” for 2 second. When lane barrier signal is red (hold), the sequence shall follow “Clear to Barrier Preemption” shown in the chart. The barrier “close” circuit shall be suppressed in accordance with the table and clearance sequence chart.



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)

Cont.

Barrier Activated Regardless of Reason T=0	Signal Color Time After Activation, T = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	SAFETY CONTROLS							Barrier Status
		Vehicle Presence on Loop (L) or Beam Sensor Broken (BB)			Automatic Gate		Barrier Lights		
		L - 1 & 2 or BB - 6	L - 3 or BB - 7	L - 4 or BB - 8	Lights	Arm	Pavement or Barrier	Post Mounted	
	Normal State	-	-	-	Dark	Upright	Dark	Dark	Down
X	Green, 0	Y	Y or N	Y or N	Dark	Upright	Dark	Dark	Down
	Red (hold), 1	Y or N	Y	Y or N	Dark	Upright	Dark	Dark	Down
	Red (hold), 2	Y or N	Y or N	Y	FR	Upright	Dark	Dark	Down
	Red (hold), 3	Y or N	N	Y	FR	Upright	FR	R	Down
	Red (hold), 4	Y or N	N	N	FR	Start Down	FR	R	Start Up
	Red (hold), 5	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 6	Y or N	N	N	FR	Going Down	FR	R	Going Up
	Red (hold), 7	Y or N	N	N	FR	Down	FR	R	Up

Cont.

Loop Detector and Signal Operation:

4. System Safety Check prior to Barrier Deployment – The microprocessor controller shall check both operational status and detection status of L-3, L-4, BB-7, and BB-8 prior to its “Start Up” deployment. Under no circumstance will the lane barrier deploy when one or more detectors is (are) not operational, is (are) off line with system, or have a call.

Loop Detection and Beam Sensor Priority Control During Preemption

Loop	Break Beam Sensor	Likely Signature	Governs Microprocessor Timing/Clearance prior to Barrier Deployment
Presence on 3	Beam 7 broken	Motor vehicle	Loop Governs
No call on 3	Beam 7 broken	Bicycle, Moped, scooter, etc.	Beam Sensor 7 governs and times 3 seconds passage (adjustable) after beam 7 reconnects. Additional breaks of beam 7 resets passage time. If Beam 8 is not broken within 5 seconds (adjustable), the call is assumed false (bird, animal, leaf, weather, etc.) and the barrier deploys.
Presence on 4	Beam 8 broken	Motor Vehicle	Loop Governs
No call on 4	Beam 8 broken following Beam 7	Bicycle, Moped, scooter, etc.	Beam 8 Governs and times one second passage (adjustable) after each beam 8 reconnects. Additional breaks of beam 8 resets passage time.
No call on 4	Beam 8 broken following no breaks of Beam 7	False Call (bird, animal, leaf, weather, etc.)	Beam 8 Governs and times one second passage (adjustable) after each beam 8 reconnects. Additional breaks of beam 8 resets passage time of one second.



SDDCTEA Recommended Concept Plan for Lane Barrier Signal Operation (Limited Real Estate Response Zone)

Control	Normal Operation Signal Control by Detection System			Clear to Barrier Preemption	Clear 1 from Barrier Preemption	Clear 2 from Barrier Preemption	Clear to Queue Preemption	Clear 1 from Queue Preemption to Normal Ops	Clear 2 from Queue Preemption to Normal Ops	Clear 1 from Queue Preemption to Barrier Preempt	Clear 2 from Queue Preemption to Barrier Preempt
	No activation on Loops 1 and 2 or BB 6	Activation on Loops 1 and 2 or BB 6 and after set delay	Activation on Loop 3 or BB 7 regardless of activation on Loops 1 and 2 or BB6	Traffic held at Stop line. Activations on Loops 3 or 4 or BB 7 or 8 holds barrier from deployment.	Activation on Loops 1 and 2 or BB 6. Traffic held at Stop line.	Activation on Loops 1 and 2 or BB 6. Traffic held at Stop line.	Loop 5 activated by vehicle occupancy greater than preset time, say 15 seconds (adjustable)	Automatic 3 seconds yellow clearance	All red for 2 seconds before return to Normal Operation	Automatic 3 seconds yellow clearance	Traffic held at Stop line. Activations on Loops 3 or 4 or BB 7 or 8 holds barrier from deployment.
Signal				(Red Hold) 	(Red Hold) 	(Red Hold) 	Flashing Yellow 	Steady Yellow 		Steady Yellow 	(Red Hold)
Signs	Static Signs or Electronic Blank-out 			Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out 	Static Signs or Electronic Blank-out
Barrier Safety Controls	Gate Arm – Up Gate Lights – Dark Barrier Lights – Dark			Gate Arm – See Table Gate Lights – See Table Barrier Lights – See Table Barrier – See Table	Gate Arm – Down Gate Lights – FR Barrier Lights – FR Barrier – Going Down/retracting	Gate Arm – Going Up Gate Lights – FR Barrier Lights – Dark Barrier – Down/retracted	Gate Arm – Up Gate Lights – Dark Barrier Lights – Dark Barrier – Down/retracted	Gate Arm – Up Gate Lights – Dark Barrier Lights – Dark Barrier – Down/retracted	Gate Arm – Up Gate Lights – Dark Barrier Lights – Dark Barrier – Down/retracted	Gate Arm – Up Gate Lights – FR Barrier Lights – Dark Barrier – Down/retracted	Gate Arm – Going Down Gate Lights – FR Barrier Lights – FR Barrier – See Table

